



## **Spring 2018 Senior Design Showcase** **and Duke Energy Symposium on Renewable & Sustainable Technology**

***NEW! 2018 Florida-Wide Student Engineering Design Invitational***  
*Nine engineering colleges join UCF in the showcase*

**Thursday, April 19**

### **Schedule**

**Industry Partner Breakfast\***

*Idea Lab, Engineering II Atrium (\*by invitation only)*

**8 a.m. – 9 a.m.**

**Duke Energy Symposium**

*Texas Instruments Innovation Lab, Engineering II Atrium*

**9 a.m. – 10 a.m.**

**Introduction:** Michael Georgiopoulos, Dean

**Keynote:** "Rockets to Toilets: A Commentary on Renewable Energy and Water Conservation" presented by Doug Guidish, '07, Founder and CEO, Guard Dog Valves

**Featured Student Team:** "Home Cooling with Innovative Glass-Polymer Metamaterial"

With additional research, this team's composite glass-polymer metamaterial has the potential to drastically reduce the energy usage and cost of cooling a home through the concept of "passive radiative cooling." By graduating Mechanical Engineering students David Ridgway, Bryan Fisher, Zachary Heiser, Andrew Hough, Olwatomisin Otegbeye, Makenzie Wells

**Showcase of Projects**

*Engineering I & II, Harris Engineering Center, and HEC Tent*

**10 a.m. – 3 p.m.**

**Awards Reception**

*Engineering II Atrium*

Enjoy refreshments as UCF engineering and computer science alumni volunteer judges from industry recognize the top projects in each discipline, the top visiting project and Best-In-Show

**3:30 p.m. – 5 p.m.**

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# UCF Projects Involving Multiple Disciplines

## **Solar Sculptures Proposed for Orlando City Stadium, Sponsored by Orlando Utilities Commission**

Three teams have been challenged by the Orlando Utilities Commission to propose a solar-powered art sculpture to be placed at Orlando City Stadium downtown, home of the Orlando City Soccer Club. A fourth team of electrical engineering students is participating as consultants to all three sculpture teams.

*Disciplines: Mechanical Engineering, Electrical Engineering, Art*

### "Giration" Soccer Ball with Filigree Shadows Solar Sculpture

*Engineering II, Table 77*

The proposed design features a rendition of a soccer ball designed with intricate filigree (lattice-work) that will cast different intricate shadows throughout the day depending on location of sun.

### "Golazo!" Soccer Player Kicking Upwards Into Net Solar Sculpture

*Engineering II, Table 78*

This sculpture instills a sense of power and possibility as it rises into a soccer net and a colored ball. As the light of day changes, so do the colors in the sculpture. The sculpture has designs on four sides of its base, with the main panel showing a silhouetted soccer player kicking a ball upwards into the net. The other three sides also have cutout silhouettes that pay tribute to the devoted fans of Orlando City Soccer.

### "Project Impact" Bursting Soccer Ball and Three Risers Solar Sculpture

*Engineering II, Table 79*

Featuring a light display, this sculpture features a split soccer ball "bursting" with risers coming from the ball, a representation of the game's power and inspiration. It is designed to allow for unique photo backdrop for fans and passerby.

## **3D Computer-Numerically-Controlled Foam Cutter for Texas Instruments Innovation Lab at UCF**

*HEC TENT Tables 92 (Team 1); 93 (Team 2); Team 3 - ENG II, Table B*

Three teams have designed and built a 3D CNC foam cutter to be used in the Texas Instruments Innovation Lab at UCF to cut and shape foam molds. This capability is needed for certain engineered projects such as the UCF Human-Powered Vehicle, an annual competition. In the past, foam cutting was provided by an outside company. A foam cutter will accommodate a variety of needs for foam molds, including freshman-made projects for the Introduction to Engineering boat competition.

*Disciplines: Mechanical Engineering; Computer Science*

## **Rapid 3D Environment Modeler**

*Engineering I, Table 53*

On this team, photonics science and engineering students worked with computer engineering students to create a way to image a room through a scanning system that generates a 3D point cloud render. Relative to the device, each data point will contain a distance of the room it is viewing. The device is automated so it may be placed down indoors and image its surroundings. There are similar surveying devices on the market today, but they are more costly or are focused on enclosed areas. Possible applications include robot vision, virtual reality, and area survey. *Disciplines: Computer Engineering; Photonics & Optics*

## **Arcadia Spider Robotic Hub for Arcadia Spectacular**

*Engineering I, Table 54*

This project is a low-cost, small-scale prototype to represent a proposed full-scale addition to the Arcadia Spider. The Arcadia entertainment brand provides stages that take sculpture, lighting, music, pyrotechnics and special effects to an ultimate level of electricity and energy, with mesmerizing performances built into its structures. This team has created a half-sphere robot (like R2D2) equipped with a camera and nerf gun to represent a full-scale fog blaster. The robot is equipped with LEDs and lasers to produce an audio-synced laser and light show. *Disciplines: Electrical Engineering; Optics and Photonics*

## *Multi-Discipline Team Projects (continued)*

### **"LASER SKEET" Safe Indoor/Outdoor Target Shooting**

*Engineering II, Table 88*

A safer way to enjoy the sport of skeet shooting, without using real firearms or a wide open space to shoot. In this project, a laser is shot from a gun and then detected by the target. It relays the information back to the shooter via radio-frequency communications to confirm a positive target hit.

*Disciplines: Electrical Engineering; Computer Engineering; Optics and Photonics*

### **Automated Solar-Powered Awning for Swedish Solar**

*HEC TENT, Table 94*

This team is introducing a revolutionary new option for solar energy: an automated awning fitted with solar panels that can be mounted on any south-facing windows. It is controllable by mobile device to open and close on demand or through a preset schedule. Provides cooling shade while collecting solar energy. It can also be used as a storm shutter during extreme weather conditions.

*Disciplines: Mechanical Engineering; Computer Science*

### **Drone-Based Microgravity Experimentation Platform for Northrop Grumman**

*HEC TENT, Tables 98 (Red Team); 99 (Blue Team); 100 (Green Team)*

For a competition sponsored by Northrop Grumman, three teams have designed and built drones that can help researchers do experiments in a microgravity environment. Currently, to achieve microgravity conditions, researchers can try to have their experiments put on a parabolic flight, which is costly and has limited availability. These concept drones are designed to carry a payload and then perform a parabolic freefall trajectory capable of generating a microgravity condition. The contest is evaluated on maximum time in reduced gravity; purest reduced gravity; and heaviest payload.

*Disciplines: Mechanical and Aerospace Engineering; Computer Science; Computer and Electrical Eng*

### **"Robocopter" Track-and-Attack Anti-UAV Defense Drone for Lockheed Martin**

*Engineering II, Tables 56 (Red Team); 57 (Green Team); 59 (Blue Team)*

The purpose of this project is to develop a drone (commonly referred to as UAVs, or unmanned aerial vehicles) capable of autonomously detecting, pursuing, and physically intercepting/attacking smaller-target UAVs. Small UAVs can be used by an enemy for malicious purposes such as spying or terrorism, so anti-UAV defensive measures are needed for security and privacy.

*Disciplines: Mechanical and Aerospace Engineering; Computer Science; Computer and Electrical Eng*

### **Systematic Diagnosis of Raw Material Receiving & Handling Procedures for Coca Cola**

*Engineering II, Table 65*

Production demand and complexity are surpassing the original design of Coca Cola's Main Street Plant facility. This team was tasked with analyzing the operational problems and proposing a solution.

*Disciplines: Industrial Engineering & Management Systems; Mechanical Engineering*

### **Process Improvement for Blending Operations at Coca Cola Main Street Plant**

*Engineering II, Table 75*

This team collected data and measurements to implement Lean/Six Sigma results such as reducing variability and eliminating waste/idleness; and introduced a statistical analysis-based approach at the plant. *Disciplines: Industrial Engineering & Management Systems; Mechanical Engineering*

# UCF Computer Science

## **Massively Parallel Computing Using Memristors**

*Harris Engineering Center, Table 1*

The memristor crossbars computing architecture could potentially substitute the Von Neumann model now used to build computers. This team added support for conditional “if-else” statements to the sponsor’s design. Given C code composed of arithmetic and conditional statements, the memristor crossbar design can take the code and produce the same results a Von Neumann computer would. The technology could potentially speed up calculations of complex problems.

## **Computational Finance: Pairs Trading with GPU Acceleration**

*Harris Engineering Center, Table 2*

Using an existing investment strategy, Pairs Trading, this is a scalable solution to compute results for potentially millions of pairs to generate returns in the stock market, leveraging NVIDIA GPUs to accelerate the work. Intended for investors, particularly equity research analysts. Today, researchers pick individual pairs and compare them using charting tools and data. This approach is purely statistical with the intention of producing pairs that researchers would not have otherwise thought to test.

## **Limbitless Solutions: Website and Mobile App**

*Harris Engineering Center, Table 3*

Intended for use by children and Limbitless employees, this website and mobile app allows users to adapt the settings on their bionic arms remotely, reducing the time and expense for families to come to campus.

## **Limbitless Solutions: 2D/3D Visualization Tool**

*Harris Engineering Center, Table 4*

Provides a low-cost alternative method for Limbitless clients to preview their bionic arms. Previously the only way to preview an arm was with an image or a fully-printed model. A mobile and desktop application allow clients to view the prosthetic realistically without printing it.

## **Limbitless Solutions: Race Car Training Program for “Project Xavier” Headband**

*Harris Engineering Center, Table 5*

Video game that trains users on the Xavier headband, the device that helps quadriplegics drive their wheelchair with facial movements. This game employs the headband as the controller, mirroring the wheelchair controls. Users can train in a safe environment and it will calibrate the headband to the user’s settings. The headband works with EMG (electromyography) – technology that measures the electrical pulse of muscle movements. The headband could be used to play other video games.

## **Orlando City Soccer: Injury Risk Predictor**

*Engineering I, Table 46*

Software to properly manipulate, understand, view and share the plethora of data that the hardware is gathering on an individual player. Data can be uploaded easily and processed in the cloud in seconds, and will relay useful metrics about a player, accessible to medical staff, coaches and players via account logins to develop treatment and practice plans for individual players.

## **Orlando City Soccer: Performance Analysis and Injury Risk Prediction**

*Engineering I, Table 47*

Transforms a player’s raw performance data into actionable insights, to predict a player’s risk for injury. Displays a visual analysis of all collected metrics. Data collected includes GPS data, hamstring measurement, push-up tests, data over a variable range of dates, etc. The percentage change of fatigue-related injury is determined using machine-learning technology. The easy-to-access application also provides a comprehensive summary of reports to determine the fitness state of each player.

**raveltree Collaborative Storytelling Application**

*Harris Engineering Center, Table 8*

This project will transform storytelling into a unique social experience for participants. The application enables a story leader (the "ravel" host) to post a concept and passage for their story (a "ravel"), then invite others to collaborate and add or edit the passages, all while making it fun with the ability to upvote or downvote stories. The hope for raveltree is that it will provide an innovative platform for writers to create stories in a new collaborative way. It can also be used in the classroom to help students improve writing, communication, teamwork and critical thinking skills.

**Medical Asset Tracking via Blockchain**

*Harris Engineering Center, Table 9*

Designed to protect the medical asset supply chain system from tampering, dilution and other problems. Uses blockchain technology to keep accurate, verifiable tabs on every step of the journey, from the drug manufacturer to the final distributor. This project could be used in any asset tracking.

**Depression Triage Tool**

*Harris Engineering Center, Table 10*

To reduce human error in identifying and prioritizing patient treatment by identifying patients symptomatic of depression, so that if missed in the initial screening, this system would flag the patient for re-evaluation. This project applies Natural Language Processing Techniques to text that is input by the patient.

**Tabletop Roleplaying Game Companion**

*Harris Engineering Center, Table 11*

Through a database and web application interface, this project is designed to assist people in organizing a game group and scheduling in-person gameplay of Dungeons & Dragons 5<sup>th</sup> edition players. It can be applied to other tabletop games. This project places emphasis on the physical meeting portion of playing tabletop games, while also providing a polished and easy-to-use interface, free-of-charge.

**Ludus: Competitive Programming Learning Platform**

*Harris Engineering Center, Table 12*

Designed to assist UCF's Computer Programming competition team, this learning platform streamlines the process of finding practice problems appropriate for an individual's knowledge and skill level. Team coaches will use it to 1) create and post problems for students to solve; (2) create, post and edit learning modules to introduce students to topics; (3) help students find problems suitable to their skill set. The tool will replace the current process of manually editing and uploading html files, tackling problems that are managed by another interface, submitting solutions and viewing results through another website.

**Distributed Simulation of an Autonomous Mars Base for NASA**

*Engineering II, Table 67*

Demonstrates the feasibility of an autonomous resource-gathering base on Mars. NASA scientists will use the simulation to collect data to maximize success of a base on Mars. The simulation includes autonomous prospecting and excavating rovers which collect soil-containing water. The soil is put through a facility to convert the water within the soil and the CO<sub>2</sub> within the atmosphere into rocket fuel.

**Critical-Thinking Game for UCF Games Research Group**

*Harris Engineering Center, Table 15*

Developed for research, the game will be used to determine whether critical-thinking skills can be trained and can increase by playing video games. This project takes the player (the detective) through a murder mystery where they will have to play mini-games and discover clues to unveil the killer. This project allows for assessing the players to determine whether critical thinking increased.

## *UCF Computer Science (continued)*

### **Nextgen Asset Tracker**

*Harris Engineering Center, Table 16*

This project combines GPS and an Inertial Navigation System (INS) to track the location of a small device at all times. The location is reported back to a server where the user can see, in real time, the device location. Could be used by construction companies to know exactly where expensive equipment is located. When GPS is unavailable, the Inertial Measurement steps in and uses the last known GPS location and calculates a new GPS location based on the movements it has detected.

### **Nextgen Asset Tracker: GPS & Inertial Navigation**

*Harris Engineering Center, Table 17*

GPS is not always available, for example, indoors or underground. Radar systems cannot track small objects on the ground in real time. This project is a low-cost Internet of Things inertial navigation solution, capable of working indoors or outside, independent of global navigation infrastructure.

### **Enhancing Google's Domain Adaptation Research**

*Engineering II, Table 68*

To create a better architecture compared to existing Google research on pixel domain adaptation. The team applied modified machine learning to the same datasets used by Google. In the computer vision field, a goal is to create algorithms that can identify objects and settings in images. Google's research focus has been to give an algorithm the ability to innately identify objects in different settings (domains). By having an architecture that can generate its own images, it is inferring what objects are in its own generated images. Researchers are trying to apply this to real-world images and settings. Could be used in crime prevention, search and rescue and medicine.

### **Balloon-Assisted Microgravity Experiment Ground Control**

*Harris Engineering Center Room 101, Table 19*

A balloon that is dropped and reeled back up to provide up to 30 seconds of micro-gravity for testing payloads, to ultimately improve, and reduce cost, of how research is done in microgravity environments. This team's demo will be a web interface and sample data.

### **Amazon Alexa Game Maker**

*Harris Engineering Center Room 101, Table 20*

Currently there are not many tools to create a game on the Amazon Alexa platform. This project will enable game developers to quickly and easily create a "text" adventure-styled game to be played on Alexa. The tool will enable the use of sound effects, keep track of stats and high scores, and use smart home lighting to create an immersive gaming experience.

### **mARket: Augmented Reality Marketplace**

*Harris Engineering Center Room 101, Table 21*

A mobile-friendly application to help businesses reach out to their customers by showing them 3D models of their products in real space. This project seeks to lower the barrier of entry for new businesses by allowing them to display their full inventory without having it physically present. Businesses will be able to upload 3D models of their items to a website. Amazon uses this but for only certain products. This project would allow local businesses to compete with Amazon and stay viable in the marketplace.

## *UCF Computer Science (continued)*

### **“The Slave Experience” Virtual-Reality Simulation for UCF History Department**

*Harris Engineering Center Room 101, Table 22*

An immersive and in-depth, historically accurate look into the Africa-Brazil Slave Trade in the mid-19<sup>th</sup> century. The user is placed in the virtual body of a west African person immediately after they have been abducted. They will experience the journey from the character’s homeland to a foreign country on the other side of the world. The project uses the HTC Vive Virtual Reality headset. Contains trigger warnings for violence, subjugation, bodily harm and claustrophobia.

### **Smart City Simulation for Parking**

*Harris Engineering Center Room 101, Table 23*

This project tackles the ever-present problem of parking on a college campus. The solution includes three parts: an app, a sensor, and a simulation. When the user opens the app and chooses a destination, the app will give a couple of parking choices, and will display information fed-in from the network of sensors in each garage. Once the user selects where they want to park, the app will route them to their destination.

### **Dialysis Lifestyle Android App**

*Harris Engineering Center Room 101, Table 24*

A method for dialysis patients to receive advice and encouragement to live a healthier lifestyle. The application targets diet, exercise, and social aspects of a person’s life. The application tracks mood and shows this data in a meaningful way to medical providers. Other applications include a new social media app for a specific subset of people (dialysis patients) – and a lifestyle aid for anyone.

### **“Knest” – Wildlife Photography Selection and Enhancement**

*Harris Engineering Center Room 101, Table 25*

Photographers take a large number of photos during any excursion, and spend considerable time sifting through those photos to find ideal images. Knest aims to give bird photographers a way to expedite selection and photo enhancement, reducing the time on repetitive tasks. The project uses computer vision and machine learning technology to automatically detect the presence of birds in a photograph, and subsequently produce an enhanced version of the image.

### **Computer Vision-Aided Weight Training: Video Feedback**

*Harris Engineering Center, Table 13*

Using computer vision technology, this project is intended for weightlifters to use as a resource for improving technique and efficiency, and preventing injury from incorrect form. Using Microsoft Kinect, it monitors exercise movements and provides instantaneous video feedback via a monitor. By showing lift movements in real time with visual overlay, the device can reinforce proper habits and immediately correct poor ones. The goal is to inject new technology into weightlifting, reduce chance of injury, help boost fitness levels and instill confidence in new lifters.

### **Deep Learning and Adaptive Resonance Theory for Online Control Tasks**

*Harris Engineering Center Room 101, Table 26*

Machine learning and AI researchers have long-sought to identify the main computational principles of the brain that allow humans to perform well at complex tasks requiring control (driving a car, playing a sport, etc). Google’s DeepMind developed a machine learning method that achieved record performance on retro video games, but it took several weeks with expensive hardware. This project provides an efficient, low-cost alternative by interchanging key components with deep learning approach with another method: adaptive resonance theory (never before attempted) that may achieve the same functionality with less computation. It has the potential to make machine learning more accessible to those with limited resources. It could also make autonomous robotic control easier by allowing real-life robots to learn how to solve problems quickly.

## *UCF Computer Science (continued)*

### **Mars Colonization Game**

*Engineering II, Table 70*

Intended to stimulate interest in science and math by providing a challenging, educational platform for elementary, middle and high-school-aged students. The game dynamically pits the player through the same challenges and decisions encountered in Mars missions. Collaboratively designed with NASA staff and entirely free, and mapped to the real-life surface of Mars. Anyone can simultaneously play and learn.

### **“Critical Encounters” Web Application**

*Harris Engineering Center, Table 137*

Enables tabletop roleplaying gamers to create combat-centered encounters, and test their creation against an AI that simulates the players’ actions at the table. Users can also create characters to face off against other users’ created encounters, and by doing so, test the balance of their creation. This standardized play-testing platform using artificial intelligence is not currently available in the tabletop gaming community.

### **“EventFull” Collaborative Event Planning App**

*Harris Engineering Center Room 101, Table 29*

Simplifies collaborative organization of social events by providing real-time chat and a voting system. Authenticated users may create events; invite others to events; mute or block users; mute events; propose and vote on event revisions; send, receive, approve and reject friend requests; and create user groups.

### **Virtual Reality Condition Assessment Training Tool for Florida Power & Light**

*Harris Engineering Center Room 101, Table 30*

Employees can be more safely and effectively trained with this virtual reality simulation of what they would actually encounter on the job. Environment scenarios are randomly generated. Trainees will use the application to train on assessing damages to utility poles and their equipment, and rate them on a 5-point scale. The approach is better than group training because it can be customized to individual trainees.

### **Drone Dash Pro**

*Harris Engineering Center, Table 138*

A video game that allows players to create drones that race against other drones in a simulated race. Simulated racing puts the focus on competitive design rather than player-controlled racing.

### **“Noni” Augmented Reality Restaurant Menu**

*Harris Engineering Center Room 101, Table 32*

Most menus are made up of plain text and photos, often with unclear descriptions. Noni allows restaurant-goers to view 3D models of a menu item in augmented reality to provide an authentic view of the food selection. The 3D models can be created quickly and effectively. Noni could be used in restaurants everywhere, and also by review sites such as Yelp. It can also be integrated with existing technologies (Uber Eats for example) to improve the dining and meal-delivery market. The demo will allow users to choose a supported restaurant, point it at the table and experience the food as if it were actually there.

### **WatDo: Smart, Fast Scheduling**

*Harris Engineering Center Room 101, Table 33*

This app takes away poor planning, miscommunication, apathy and decision paralysis when it comes to scheduling an activity with others. Targeted for age 18-35, this app is designed for spontaneous activity planning. WatDo considers the preferences of the user and those of friends, then scans the surrounding area for suitable places, and recommends an event that will please everyone. Machine learning technology in WatDo can automate the difficulty a group of friends encounter to agree on an activity and/or location.

## *UCF Computer Science (continued)*

### **Explorers Edge: Road Trip Planning Application**

*Harris Engineering Center Room 101, Table 34*

Designed to render suggested places faster than other trip planners, users input their origin and destination and a route displays with suggested stops. Users can click on stops to see ratings and comments from other users. The trip can also be saved. The app tells users the most selected stops on a route; and users can customize their suggested stops by specifying preferences.

### **LEAP Motion Games**

*Harris Engineering Center Room 101, Table 35*

Provides a more engaging way to play video games through a motion sensor designed to facilitate human interaction. The Leap Motion device will allow the user to play the developed games through IR-captured hand motions, providing a more physical gaming experience. Could be used in arcades or similar venues.

### **Pick-aPic Photography Contest Social Application**

*Engineering II, Table 71*

A new social media brand with weekly photo contests, targeting ages 13-21. This web and mobile application is accessible from home or on-the-go. The mobility, user interface and voting algorithms is what makes Pick-aPic unique.

### **Accordion: Data Compression Research**

*Harris Engineering Center, Table 31*

The need to save hard drive space to store the exponentially large amount of data being used by industry, academia and research centers drives this project. The Accordion method allows further compression of data by 15-20 percent over existing compression algorithms. The pre-processing of input data will save hard drive space on devices, and increase bandwidth to allow streaming services to support an influx of users, thus creating more revenue and a better user experience.

**Automatic Detection of Emotions** Technology using UCF's interactive program, TeachLive.

*Harris Engineering Center Room 101, Table A*

# UCF Electrical and Computer Engineering

## **Player Illuminated Negativity Killer**

*Engineering I, Table 36*

A board with a grid of light-up LED buttons to play a variety of games. Targeted to the household game market, this board does not require game pieces which could get lost, and provides a variety of games. It also eliminates illegal moves that can be encountered in traditional board games, but provides the tactile feedback that can't be achieved on a digital tablet or other electronic game device.

## **“SigSent” - Six-Legged Robot that Walks or Rolls**

*Harris Engineering Center, Table 139*

A real-life transformer, this surveillance assistant demonstrates the robotic intelligence to differentiate terrain (rough or smooth) and adapt accordingly. Six legs enable the robot to walk over rough terrain like an insect. When it encounters a smooth surface, the robot's mobility mechanism switches to wheels for smooth-rolling.

## **Water Analogy Project to Simulate Electronic Circuit**

*Engineering II, Table 85*

Simulation of a basic electronic circuit using water flow as an analogy for electric current. Users select between three active electronic components and their respective parameters. The system will adapt to display how an electronic component would behave using water pressure and its current analogously representing voltage and electric current. This never-done-before method could be used in classrooms to provide an interactive visualization of what the circuit undergoes.

## **Safe Construction Unmanned Aerial Vehicle**

*Harris Engineering Center, Table 132*

An automated drone that uses computer vision algorithms to build a Styrofoam structure. The project is inspired by the concept of using multiple drones working together to complete tasks such as building structures. Using drones this way could improve construction worker safety as drones are smaller and compact and would reduce or eliminate the need for large dangerous machinery to perform certain tasks.

## **Remote Switchgear System Circuit Breaker Controllers for ABB**

*Engineering I, Table 42*

This team developed a handheld controller that allows the operator of a switchgear system to control the circuit breaker from a large distance away. Also, a proof-of-concept software application was developed that allows the control of one or more Switchgear systems at a worksite. It allows the operator to wirelessly operate the controls of the circuit breaker(s). Features LED lights to indicate status.

## **Wireless Analog Record Player**

*Engineering I, Table 50*

Giving a modern interface to an old technology, this Android application will be paired with this team's modified vinyl player with modern controls, including the ability to select a specific song from the album to play, as well as controlling speed and power remotely. Camera technology and machine learning technology has been integrated into the project to let the user take a picture of the vinyl record to uncover more information about the album.

## **Electronic Flip Sign Handheld LED Display**

*Engineering I, Table 51*

Displays user-programmed messages on a portable LED sign. Messages can be input from a desktop computer or an Android device. The display is made up of an LED matrix. This sign is different because its compact design can be used on-the-go. It is highly portable and easy to use, and could be used in place of paper signage. Users can easily change messages via Bluetooth connectivity.

## *UCF Electrical and Computer Engineering (continued)*

### **Karaoke Portable System**

*HEC TENT, Table 101*

The portability of this system allows performers to sing anywhere and access songs wirelessly. Bluetooth technology allows for karaoke to exist in any moment, at any time. It features three built-in speakers, as well as audio, voice and lighting effects.

### **Radio Frequency Energy Harvesting for Medical Applications**

*Engineering I, Table 43*

This system (circuit) trickle-charges medical device batteries, without user input, by harvesting RF signals in the environment emitted by cellular devices. The circuit will monitor charging process and speed, and relay the information to a mobile device application. To be demonstrated is trickle-charging an insulin pump. The proposed system is small, lightweight, and will be built into a belt, and connected to the insulin pump via hard wire USB connection. Could potentially be used in embedded devices such as biosensors, pacemakers, and artificial organs.

### **Guard Mat: Affordable Home Security Device**

*Harris Engineering Center, Table 134*

Notifies a homeowner of any presence at their door and allows for identification via a video feed. The mat is connected to a camera with an available website so that users can check the live feed. The camera activates when the mat's embedded pressure sensors detect pressure.

### **Smart Home Blackout Shades for Jetsons Living**

*Harris Engineering Center, Table 135*

The sponsor, Jetsons Living, is a smart-home technology company seeking to add a blackout shade solution to their portfolio. These shades are WiFi connected, can be powered by battery or wire, have programmable LED lighting, can be remote-controlled, and can interface with voice-activated assistants.

### **Electronics Inside the Proposed Orlando City Stadium Solar Sculptures for OUC**

*Engineering II, Table 76*

This team has served as the electrical engineering consultants to the three solar sculpture projects competing for placement at Orlando City Stadium. Sponsored by Orlando Utilities Commission. See Multidisciplinary Project summaries for details on this project involving engineering and art students.

### **"Funetics": English Language Pronunciation Assistant**

*Engineering II, Table 90*

To help people learning to speak the English language, users can physically pick up orbs with phonetic spellings and place them onto a board with sockets fitting the orb where the device will scan which phonetic was placed. Upon completion, the device will then verbally pronounce the selected placement of the orbs. Unique and interactive, this system could also be used with other languages, could be used in speech therapy, and also to teach music.

### **Handheld Programmable LED Signboard**

*Engineering II, Table 60*

Features a Bluetooth and USB accessible display, to allow people to easily send messages or program a handheld LED display with four messages that can be selected on the fly. Can be used with an Android device with Bluetooth or a desktop PC with a USB cable. Portable and easy to use.

**Smart Gloves: Motion-Tracking Weightlifting Gloves and Mobile App**

*Harris Engineering Center, Table 142*

Designed to monitor and track a user's form for a variety of weightlifting exercises, ensuring proper execution to maximize benefits and minimize injury risk. A robust inertial measurement unit mounted on a small PCB will track the movement of each glove and transmit the data through Bluetooth to the user's smart phone. The data will be processed with a companion application. It could also be used in physical therapy for rehabilitative exercises.

**Smart Security Dash Camera**

*Engineering II, Table 86*

Vehicle-monitoring system allows users to catch everything on video that is happening in and around a person's vehicle at all times. 360 degree view is achieved with two wide-angle HD cameras. It uses GPS, WiFi to connect to a phone and send video. Discreet design is hidden from thieves.

**"Easy Park" Easy-to-Install Parking Monitoring System**

*Harris Engineering Center, Table 136*

Designed to solve crowded parking situations at peak times, this easy-to-install monitoring system uses an app capability for highlighting the occupancy of garage parking decks, or any parking lot. Battery powered and solar-rechargeable, the device uses an ultrasonic sensor to sense a parked vehicle. When a space is occupied, the directly-connected LED will turn on and appear green outside the parking space. When the vehicle leaves the space, the LED will turn off.

**Automated Fermentation Device**

*Engineering II, Table 64*

Makes home brewing safer, cleaner and more efficient. Monitors beer fermentation temperature and pressure, and relays data back to the user who can monitor and control the temperature by turning on/off the refrigerator storing the carboy. Prototype is easier to use, and less expensive than similar products on the market, and provides more information and a better user interface.

**Smart Cabinets with Mobile Access Control, BLE Communication and App**

*Engineering II, Table 89*

Scalable smart cabinets with mobile access control, inventory keeping, and the ability to be remotely interfaced. Easy-to-use, efficient, reliable and convenient. Could be integrated into medicine cabinets, protecting personal belongings or even keeping kids away from junk food. The system also uses weight sensors to notify the user when something is moved in the cabinet.

**Auto-Knight: LiDAR-Guided Autonomous Car**

*Engineering II, Table 63*

A modified remote-controlled vehicle transformed into a self-driving vehicle. Uses a camera, LiDar, and ultrasonic sensors to map and navigate its environment using machine learning algorithms and path planning while also being able to send this information to other vehicles via 802.11 communication protocol. Sponsors in the Networked Systems Laboratory will use the design to a fleet of these vehicles as a state-of-the-art testbed that will be used in future projects to improve the safety of self-driving vehicles.

**Automated Pet Feeder**

*Engineering I, Table 44*

Designed to help pet owners. This project tracks amount of food consumed through different pet profiles and notifies owner when it is time to reorder food. The feeder will dispense the exact amount of food required. To prevent food stealing, the feeder can only be accessed through RFID collar recognition.

## *UCF Electrical and Computer Engineering (continued)*

### **X-Car Electrical Maintenance Tool**

*Engineering I, Table 45*

Alleviates troubleshooting difficulty at the Hollywood rip ride rocket rollercoaster at Universal Orlando. The system provide troubleshooting abilities that off-the-shelf equipment cannot provide. In theory, this device can be modified for attraction equipment at other venues.

### **"MEDLOCK" Automated Pill Dispenser**

*Engineering II, Table 61*

Regulates pill disbursal with a timer programmed into a microprocessor with the MEDLOCK's casing. When the timer hits the specified time between dosages, the pill will be made available, and the user will be notified visually, audibly and through Bluetooth notifications. The user presses a button to dispense the pill and the process is repeated.

## **UCF Industrial Engineering and Management Systems**

### **Introducing Operating Standards to Increase Efficiency and Production**

*Engineering II, Table 72*

This team was tasked with addressing ways in which the client could increase production through targeting downtime, reducing setup time and improving product quality. The company will use the proposed solutions to train and retrain employees in new standardized procedures. Having standardized procedures ensures all workers are following the correct instructions to increase efficiency, eliminate variation, and potential causes of defects.

### **100 Days to Parrish Perfect: Central Referral Office**

*Engineering II, Table 74*

Process improvement to optimize the Central Referral Office within the Titus Landing Parrish Medical Center. The CRO serves as a central communication hub among several internal departments and patients. Project scope spans from when the physician writes the referral to when the CRO employees send it to the scheduling center. The team defined, documented and mapped the current process; analyzed problems encountered; and collected data, and proposed ways to expedite services, increase production and throughput, decrease wait times, and better-use employees' time.

### **Standardized Testing Procedures and Construction Packets for I-Con Systems Oviedo**

*Engineering II, Table 81*

Intended to eliminate damaged or destroyed finished components to save I-Con time and resources. The testing procedure will give a set guideline for employees to follow step-by-step to reduce variation. This is considered an improvement as the client currently does not have a standardized testing procedure or construction packets for many of their products.

### **Florida Hospital Inventory Management Improvement**

*Engineering II, Table 82*

This team has been tasked with redesigning the storage facilities and carts for cleaning staff, to decrease room turnover time. The team timed current cleaning tasks to pinpoint areas of improvement. Recommendations include new storage designs, products, and restocking policies. The suggested redesigns will be implemented on one floor of the hospital where time studies will be redone and compared with past data.

**Mathematical Modeling and Simulation of Crowley Maritime Alaskan Fuel Distribution**

*Engineering I, Table 55*

Client delivers fuel to remote parts of Alaska that are not easily accessible. This team determined the optimal configuration (quantity and type) of fuel distribution vessels to minimize cost while meeting customer demand, using mathematical modeling and simulation.

**Florida Hospital Patient Life Cycle – Systems Layout**

*Engineering II, Table 83*

This team mapped out the course of a patient's journey throughout the healthcare system: focusing on the Adult Life Cycle, involving the multiple variations a person undergoes as they traverse the system. Median times that processes take; length of time of each stage; number of tests; practitioners; machines encountered; and most importantly, the data documentation that is generated and collected in the hospital.

**Pick Path and Slotting Optimization for FreshPoint**

*Engineering II, Table 84*

This team is continuing the focus on the development of the new FreshPoint warehouse. A previous senior design team's bare-bones design is being evolved to propose proper slotting arrangement from a customer's perspective. This team observed shipping and receiving processes, order sizes, and configurations of the orders within slots, and analyzed constraints; and then designed an efficient pick-path flow.

**Siemens FAST Facilities Operations Phase 2**

*Engineering II, Table 66*

Partnering with Siemens Energy FAST Warehouse, this team created an accurate simulation model of the receiving and storage process to allow identification of potential process improvements. Created based on the facility's new and old test data to depict an accurate representation. The simulated model of recommended changes will allow client decision-makers to watch how the new process would operate more efficiently.

**Mars In-Situ Resource Utilization Plant Simulation for NASA**

*Engineering II, Table 87*

This team used Simio to replicate the in-situ, autonomous fuel production process on Mars. NASA will use the simulation results to iterate Martian soil mining research and plans. The autonomous fuel production system modeled is one of the preliminary steps for establishing future colonization on Mars.

**Defect Reduction for Total Refrigeration Gaskets, Inc.**

*Engineering I, Table 41*

The client wants to ensure their gaskets fit and seal properly, as they continue to grow their manufacturing division. This team evaluated the manufacturing process and identified ways to reduce the number of defects.

**AgriStarts Facility Expansion and Process Redesign**

*Engineering II, Table 91*

The Apopka-based client strives to be one of the world's leading and most reliable suppliers of plant tissue culture starter plants and services, and is seeking to improve a process that moves plants from a small jar to a tray ready for planting. Three mechanical engineering teams have been tasked with automating the process (jar decapping; plant dislodgement from jar; plant washing) described in the Mechanical and Aerospace Engineering project summaries. Although seemingly a simple assembly-line-like process, various configurations can be employed – each affecting human efforts expended, labor hours used, area occupied, hazard/safety levels, etc. This team collected and analyzed data to recommend a facility layout with simulated output for the new process compared to the existing one.

## *UCF Industrial Engineering and Management Systems (continued)*

### **Siemens Human Performance Reporting and Metric Tracking**

*Engineering I, Table 37*

This team was tasked with recommending ways to consolidate and streamline the human performance incidence reporting (HuP) system at Siemens. The system will be integrated with two other reporting systems already in use to reduce redundancy. HuP reports are written by project managers and are used to implement changes to prevent future incidents. In the current reporting system, reports are seldom filed which leads to repeated incidents, some of which come at a great financial cost. The integrated system will lead to project managers more likely reporting a human performance accident, and thereby increasing transparency, reducing risk and costs and increasing workplace safety.

### **Payload Ground Support Equipment Operations for United Launch Alliance**

*Engineering I, Table 40*

The Ground Support Equipment operations team is making unnecessary trips back and forth from various processing facilities to pick up and transport equipment needed for assembly of the rocket payload. This team recommended a process that allows the GSE team to determine all the required equipment needed to reduce the time and cost of traveling to various sites.

## **UCF Mechanical and Aerospace Engineering**

### **Pole Tilt Sensor for Florida Power and Light**

*HEC TENT Tables 95 (Green Team); 103 (Red Team); 104 (Blue Team)*

Three teams designed a device that provides a simple, low-cost way to measure tilt in power line poles. Consumes little energy and built to last about 20 years.

### **Suspension Arms for UCF Society of Automotive Engineers Baja Team**

*HEC TENT, Table 121*

New designs are lighter and stronger than before. This team has also designed and constructed a device to test physical copies of the arms. It is adjustable to fit a variety of arm designs.

### **Arc-Resistant Rear Integrated Switchgear Door**

*HEC TENT Tables 128 (Black Team); 129 (Gold Team)*

Inside a switchgear, an arc fault is a giant spark that generates hot gas and pressure that must be contained by a door design. This means the door must withstand a powerful blast. The team was tasked with optimizing the company's existing design. The switchgear is installed inside of an e-house, posing an accessibility issue. This design can be directly attached to the rear of the e-house. The teams have also designed a new frame.

### **Switchgear for Large Buildings: ABB Unit Market Conversion**

*HEC TENT Tables 130 (Team Gold); 131 (Team Black)*

Two teams were tasked with transforming an ABB switchgear product to be used by companies on large buildings. They created an outdoor variant; included new fuse connectors; and allowed for cables to enter from the roof of the building into the bottom of the switchgear.

## *UCF Mechanical and Aerospace Engineering (continued)*

### **AgriStarts: Lid Decapping**

*HEC TENT Table 107*

The Apopka-based company AgriStarts is a leading supplier of plant tissue starter plants. Current operations are manually-labor intensive: a technician picks up a case of 30 jars, removes each cap, then shakes out the plant into a sink to be washed. This team's solution for automated lid-decapping involves a wedge device that the technician pushes the tray through. The procedure will decap 30 jars in one fluid motion. Once caps are removed, they fall onto a slanted exiting platform for cap storage.

### **AgriStarts: Plant Dislodgement**

*HEC TENT Table 108*

For years, AgriStarts' plant dislodgement process was performed by hand, taking hours to remove sprouting plants one-by-one. This is a lever-and-gear system to dislodge plants from a tray of 30 jars at once. After receiving a tray of decapped jars, a bracket is placed over the tray and the tray is placed in this team's mechanism. A rack and pinion gear system raises the tray and then abruptly forces it downward. The force removes the plants from the jar. The plants then go on to be washed.

### **AgriStarts: Plant Washing System**

*HEC TENT Table 109*

An automated system to wash juvenile plants (sprouted from stabilized media) to prevent growth of fungus after the customer transplants the sprout.

### **Design-Build-Fly Challenge: American Institute of Aeronautics and Astronautics**

*HEC TENT Table 110*

A remote-controlled regional and business blended-body aircraft capable of carrying passengers and cargo. This project is designed to produce the most amount of life with the smallest possible size. This design could potentially make way for a more efficient design for regional aircrafts.

### **ASHRAE: Integrated Sustainable Building Design**

*HEC TENT Table 106*

UCF students in the American Society of Heating, Refrigeration, Air conditioning Engineers design large-scale systems to make buildings more efficient. This year's competition challenged teams to design a system for a hypothetical investor wanting to construct a four-story, 70,000 square-foot building in Istanbul, Turkey.

### **Home Cooling: Glass-Polymer Metamaterial for Passive Radiative Cooling**

*HEC TENT Table 96*

With further research, the energy use and costs of cooling a home or commercial building could be drastically reduced with this composite metamaterial containing tiny glass spheres dispersed in a thin sheet of transparent polymer, which is applied to an aluminum foil backing. Once applied to the roof, the polymer and glass spheres allow radiative heat to be emitted back into the atmosphere, away from the building. The material cools the house with zero energy input.

### **Distributed Electric Propulsion to Increase Aircraft Efficiency**

*HEC TENT Tables 114 (Pegasus); 115 (Team 2); 116 (D.A.E.D.A.L.U.S.); 117 (Team 4)*

Multiple electrically-powered motors distributed along the edge of an aircraft wing allow for increased speed, range and more efficient flight. The design means more efficient distribution of lift across the wing, less noise, and an environmentally friendly method of flight.

## *UCF Mechanical and Aerospace Engineering (continued)*

### **Bright Solar Eave**

*HEC TENT Table 127*

A direct-to-consumer, DIY solar-powered exterior lighting system. The Bright Solar Eave attaches to a residential rain gutter and uses solar energy to power a multi-colored remoted-controlled light strip. Features an extended run time and the ability to control light color to create festive home lighting.

### **Hybrid Motor Rocket for Florida Space Grant Consortium**

*HEC TENT Tables 118 (Team Daedalus); 119 (Green Team); 120 (Red Team)*

Hybrid-powered rockets deliver the powerful thrust of a solid motor, while maintaining the safety and controllability of liquid fuels. While not a new concept, hybrid rockets are considered tricky to design and operate. This challenge is for teams to design, build and fly a hybrid motor rocket for a maximum altitude challenge, that would be hypothetically sold as a commercially-available kit.

### **"The Drip Buddy" HVAC Solution Dispenser**

*HEC TENT Table 97*

An IV-drip for air conditioning systems. This innovative method prevents algae, mold and gunk buildup in an air conditioning system's drain pipe which can lead to line blockage, expensive repairs and even flooding inside the home. Currently, to prevent the buildup, residents must pour a cup of bleach into the drain line every month. The Drip Buddy eliminates this hassle by providing a method to slowly and continuously treat the drain line with white vinegar to alter the pH level of the drain water. System involves a gravity-fed fluid dispenser with very small silicone micro tubing.

### **Magnetocaloric Cooling Device**

*HEC TENT Table 123*

The magnetocaloric effect is a property that certain metals have. When these metals are placed in a magnetic field, they heat up, and when heat is removed and the metals are taken out of the field, the temperature drops below room temperature, allowing for an object or space to be cooled. This system consists of a linear motion device, the rare metal Gadolinium, powerful magnets, thermoelectric modules, and two liquid cooling loops. This method could be used to replace present-day refrigeration.

### **Modular Building Design**

*HEC TENT Table 124*

A hybrid means of construction designed to revolutionize the modular home building industry. The system involves traditionally-built (stick built) and modular construction methods. This team has designed a system to erect a structure in record time, which ultimately provides a safer and more relaxed construction site.

### **Formula Racing Ergonomics: Society of Automotive Engineers**

*HEC TENT Table 143*

This project addresses the ergonomics of the Knights Racing Formula car's cockpit, with design modifications that serve the driver. Modifications include a more robust seating position, a steering wheel with better grip to lessen driver fatigue; paddle shifters with upgraded responsiveness; foot positioning enhanced with a lighter and adjustable pedal box assembly; horizontally-oriented master cylinders for better brake ratio; heel plate that conforms to the driver's shoes; and an electronic throttle pedal.

### **Formula Racing Wheel: Society of Automotive Engineers**

*HEC TENT Table 144*

The club's Formula team is in need of a new wheel design. Wheel improvements include lower cost, lighter weight. The wheel will be easier to manufacturer and done in-house, all while complying with Formula SAE competition rules and guidelines. Finite element analysis (FEA) was performed in Solidworks and ANSYS to test for failure under applied loading.

## *UCF Mechanical and Aerospace Engineering (continued)*

### **Solar-Powered Thermal Desalination**

*HEC TENT Table 113*

A new desalination technique for water purification that is more efficient and effective than current technologies. The patent-pending prototype evaporation chamber will provide clean drinking water while requiring less maintenance and upkeep during operation. The process works through evaporation and condensation inside a vertical heat exchanger. The entire system is lowered from atmospheric pressure to facilitate water evaporation at a lower temperature. Then, steam is pushed into one half of the heat exchanger cell to heat the central plate. While the steam condenses and exits, salt water is taken into the other half of the cell, evaporated from the heated central plate, and the purified water is collected for drinking. The remaining brine is removed for further use.

### **Micro Unmanned Aerial Vehicle Competition**

*HEC TENT Tables 102 (Blue Team); 112 (Green Team); 122 (Red Team)*

This competition challenges teams to create a fixed wing, electrically propelled drone in a "pusher" style configuration carrying a 32-fluid-ounce payload. A lightweight, high-endurance aircraft. The goal of the project is to maximize range, while minimizing power usage. The competition calls for reaching a maximum number of laps while surviving takeoff and landing.

# 2018 Florida-Wide Student Engineering Design Invitational

Nine engineering colleges join the 2018 host, University of Central Florida College of Engineering and Computer Science, to showcase their student-made technology and designed engineered solutions. Participating institutions include Embry-Riddle Aeronautical University; Florida A&M-Florida State University; Florida Atlantic University; Florida Institute of Technology; Florida International University; University of Florida; University of Miami; University of North Florida; and University of South Florida.

## Embry-Riddle Aeronautical University College of Engineering (Daytona)

### **Maritime RobotX Challenge: USV Propulsion and UUV Teaming**

*HEC TENT, Table 125*

The bi-annual global competition challenges collegiate teams to design, fabricate and program a 16-foot-long autonomous surface vessel. The ERAU team and its platform, Minion, has competed since its inception in 2014. This year's team has re-designed the platform to allow multi-vehicle teaming and developed a unique propulsion system. The teaming system allows Minion to carry, deploy and retrieve a small submarine, and control submarine operation from the host platform. For propulsion, ERAU's team has re-designed the motor pods to incorporate azimuth control of the thrusters and electromechanical raising and lowering of the thrusters to improve deployment, retrieval and system beaching. The Challenge cultivates students' mechanical design, electrical design, system integration and software development skills.

### **Hybrid-Electric Camaro ESS for EcoCAR3 Competition**

*HEC TENT, Table 126*

Sixteen universities are challenged to refit a stock 2016 Camaro into a hybrid-electric vehicle. As the only university representing Florida, Embry-Riddle's Camaro EcoSuper Sport (ESS) maintains the aesthetic appeal of the classic Camaro while improving the environmental impact of high performance vehicles. It gets 57 MPGE (miles per gallon gas equivalent), goes 0 to 60 in under 5 seconds, and has 657 foot-pounds of torque and 350 horsepower. In addition to developing the newest hybrid vehicle technology – including Adaptive Driver Assistance Systems and Battery technology – the Embry-Riddle EcoCAR 3 team teaches students the skills needed in the automotive industry.

### **Integration of Augmented Reality and Neuromuscular Gesture Recognition for Remote Vehicle Operations**

*Engineering II, Table 80*

A more natural control system that mimics human-to-human interaction for a human-to-vehicle interface. By integrating wearable devices as a control system, operators gain mobility and situational awareness. A gesture recognition armband is worn around the operator's forearm and reads signals produced by their muscles to recognize the hand signal they are acting out. An augmented reality headset overlays supplemental information on glasses in front the user's eyes without obscuring the users natural sight. The entire system is a secure network that allows long-distance communication between users and vehicles. Integrating emerging technologies in AR, neuromuscular gesture recognition, and secure mobile networks will provide a more natural human-in-the-loop control system.

**Florida A&M University – Florida State University**  
College of Engineering (Tallahassee)

**Autonomous Ground Vehicle Platforms for DeXter™ System**

*Engineering I, Table 49*

An autonomous ground vehicle for the DeXter™ hybrid additive manufacturing system developed by the High-Performance Materials Institute that could replace the industry standard of single machine operations. The system facilitates multiple machines to work cooperatively to enable simultaneous fabrication of unique and customized builds. The AGV incorporates: an interconnective design between multiple agents, omnidirectional drivetrain, closed loop position control, computer vision localization and IoT infrastructure. A Six Sigma DMADV developmental approach provides value-added qualities and ensures critical-to-quality customer requirements. A fully realized DeXter™-AGV environment will optimize machine availability, reduce machine downtime, and decrease cycle time and tact-time per unit build. This AGV costs 95% less than similar machines on the market.  
*Disciplines: Industrial Engineering; Mechanical Engineering*

**DriGo Weather Protection System for Wheelchair Users**

*Engineering I, Table 48*

This motorized umbrella mounts to the back of a wheelchair and deploys with a single touch of a button. Automatic deployment and retraction will help wheelchair users with less upper body mobility to open the device without assistance. An inverted umbrella design is used to avoid hitting the user as the umbrella opens, and to avoid dumping water as it closes. Wheelchair users are more vulnerable in extended rain because the restrictions in their mobility prevent them from properly drying. A device such as DriGo will keep them dry and improve quality of day-to-day life and help prevent illness caused by extended rain exposure.

*Disciplines: Mechanical Engineering, Computer Engineering, Electrical Engineering*

**PowerNap: Electrically Stimulating Oral Appliance for Mild to Moderate Obstructive Sleep Apnea**

*Harris Engineering Center Room 101, Table 18*

OSA patients experience periods during sleep when their throat muscles relax and soft tissue blocks the airway at the back of the throat. When the airway is obstructed, they do not get enough oxygen. Treatment options range from uncomfortable forced-air face masks to oral appliances that hold the mouth partially open, and even surgery in severe cases. This proposed oral appliance allows a relaxed closed-mouth position and stimulates the relaxed tissues in the throat when it senses decreasing oxygen levels. A pulse oximeter electrical component is used to sense the drop in blood oxygen saturation, which has been compared to other commercially available pulse oximeters to ensure this device is close to the sensitivity of those devices.

*Discipline: Biomedical Engineering*

**Florida Atlantic University**

College of Engineering and Computer Science (Boca Raton)

**“Oceanus Vi”: Micro Hydro-Electric Kinetic Power System**

*Engineering I, Table 52*

Oceanus Vi was designed for its potential as a personal use turbine to convert the mechanical energy of moving water into electricity, store the power and dissipate it when needed. The system provides a renewable power source which is a great alternative to fossil and nuclear fuels as they are losing their popularity.

*Discipline: Ocean Engineering*

## **Florida Atlantic University** College of Engineering and Computer Science (Boca Raton)

### **Little Havana Mixed-Use Development**

*HEC Courtyard, Table 146*

This Mixed-Use Development directly addresses the gentrification issues of the historic Little Havana area of Miami. This project is designed according to the MIAMI-21 code, the Florida Building code, and implements many of the environmental aspects of LEED to achieve a gold certification. The entailed innovative design will produce a healthy environment while optimizing energy usages.

*Disciplines: Geomatics Engineering and Civil Engineering*

### **“N.E.R.D” – Nearby Robotic Delivery Service**

*HEC TENT, Table 111*

Robotic platform designed to assist with last-mile deliveries – the movement of goods from a central transportation hub to its destination. To replace a whole postal fleet with one robotic platform is impossible; thus, this system is designed to supplement existing solutions. Designed for college campuses to aid in the delivery of mail and food across the FAU campus. NERD includes an autonomous delivery robot platform and a full ordering system that allows customers to place orders on a website or mobile app. We have also created routing algorithms and a way of securing the compartments during transportation.

*Disciplines: Electrical Engineering and Mechanical Engineering*

## **Florida Institute of Technology (Melbourne)**

### **“CARACAL” (3D Bio-Printer)**

*Engineering I, Table 39*

Affordable and versatile, *Caracal* features complete climate control inside the printing chamber to maximize humidity, control the temperature and the carbon dioxide concentration required to maintain cell viability of 3D printed tissue. It also features a laminar flow system within the chamber using a High-Efficiency Particles Arrestor (HEPA) filter along with several UV sources to maintain sterility. *Caracal* can print materials such as hydrogels with embedded cells. This bioprinter’s features and simplistic design offer a market advantage and costs \$1,500, vs current bioprinters on the market that cost \$10,000 to \$250,000. Research facilities, universities and start-up companies would benefit.

*Disciplines: Mechanical Engineering; Biomedical Engineering*

### **Aerospace Wire-Repair Intelligent Systems Experiment**

*Harris Engineering Center, Table 140*

NASA and Vencore Inc. have developed a polyimide wire repair material and method that produces a flexible, thermally stable, permanent repair for damaged wires and requires testing for use in space. This is an experimental payload carrying 30 test wire samples aboard a Terrier Improved-Malemute sub-orbital rocket to test the wire repair method in a space environment. The vehicle will carry the payload to a 150 km ( $\pm 10$  km) altitude where it will experience 200( $\pm 22$ ) seconds in microgravity. The payload is designed to heat the copper blocks to 232( $\pm 5$ )°C to activate the wire repair material, and to vent to the ambient environment to facilitate testing in the vacuum of space. Students were challenged to design the structure within the allotted dimensions, design the heater block mechanism to open and close properly, and to automate the experiment.

*Discipline: Aerospace Engineering*

## **Florida Institute of Technology (Melbourne)**

### **Scuff Protection Interface (S.P.I.) Project**

*Harris Engineering Center, Table 141*

A buffer between U.S. Navy equipment and stainless steel and polished concrete floor contacting surfaces that would not scratch, mar, or damage the contacting surfaces and could not exceed 60" length, 5" width and 0.5" thickness. The team split the S.P.I. into two sections; the top section is comprised of steel to weld to the mating surface; the bottom section is made of a polymer to prevent damage to the contacting surfaces. A reciprocal patterned geometry would be machined out of both the steel and the polymer to achieve maximum frictional forces between these surfaces. This design feature eliminated the use of fasteners and ease of maintenance. S.P.I. Bearing grade nylon (Nylatron 703XL) performed the best in extensive wear testing procedures and was selected as the final polymer material. *Discipline: Mechanical Engineering*

## **Florida International University**

### **College of Engineering and Computing (Miami)**

#### **In-Situ Mass Sensor for Materials Used in Next Generation Space Vehicles**

*HEC TENT, Table 105*

Most materials cannot withstand the extreme conditions of atmosphere re-entry, but the few that can must be thoroughly investigated for corrosion. The proposed device captures the continuous changes in mass experienced by high-temperature resistant materials exposed to velocities and temperatures similar to those in re-entry environments of flight vehicles. The proposed technology correlates the deformations experienced by the experimental testing set-up to the corrosion-induced dynamic changes in mass of materials during exposure to extreme conditions (high temperature, high velocities, etc.) Allows real-time monitoring of phenomena occurring during corrosion while simulating the environment of life-scale space vehicles.

*Discipline: Mechanical Engineering*

#### **Autonomous Real-Time Indoor Navigator**

*Engineering II Atrium, Table 69*

Addresses the tasks of supporting autonomous navigation and mapping in ever-changing indoor environments that lack GPS signals. A challenge is to maintain an accurate layout of indoor facilities to accommodate the use of devices, utilities and people that depend on precise layout configuration. This autonomous robot implements the Simultaneous Localization and Mapping algorithm (SLAM) incorporating image processing and data mining to accurately map the layout of indoor facilities. The robot that can navigate and accurately record the layout of indoor locations, upload the layout details to a centralized database, which stores and can be referenced for path planning tasks. The application of this technology will diminish the laborious and error-prone job of mapping the constantly changing layout configurations, while making the system intuitive and simple to be use. *Disciplines: Electrical and Computer Engineering*

#### **Vein Preservation System for Coronary Artery Bypass Graft Surgery**

*Harris Engineering Center, Table 6*

During this surgery, damage to the Saphenous Vein can occur due to storing the graft in stagnant solution, which can cause a higher risk of narrowing of the walls and occlusion while the vein is implanted which means that the graft will fail and the patient will need another surgery. This project improves the method of preserving the vein when out of the body. The vein will be connected to an interface that will pump nutrients through the vein using optimal flow conditions to reduce risk of vein damage. This first-of-its kind device offers reusability, biocompatibility, sterility, has a battery back-up, and warnings and kill-switches.

*Discipline: Biomedical Engineering*

## **University of Florida**

Herbert Wertheim College of Engineering (Gainesville)

### **Bench-Scale Process Design for CO<sub>2</sub> Separation and Transportation for Sustainable Large-Scale Algae Growth for Orlando Utilities Commission**

*Engineering I, Table 38*

The design features a chemical absorption column that removes at least 10% of carbon dioxide from flue gas. The proposed prototype applies fundamental concepts of CO<sub>2</sub> equilibrium chemistry to increase the solubility and capture of CO<sub>2</sub> in water. To facilitate testing and prototype validation, the team created a model composition of the flue gas to resemble the exhaust gas from OUC by mixing CO<sub>2</sub> and air in the appropriate ratio. In the proposed plant-scale design, flue gas will interact with a sodium hydroxide solution that will capture carbon dioxide and create a buffer that will be later transported to algae ponds. The bench-scale prototype column features a packed bed to increase the contact area of the medium between the liquid solution and the gas. With this design, carbon emissions to the environment from power plants will be reduced drastically and the captured carbon dioxide will be used to promote the biofuel market.

### **Telescoping Mast Drive Assembly for Harris Corporation**

*Engineering II Atrium, Table 58*

Harris Corporation has a need for a drive system to deploy its telescoping mast precisely and repeatedly in a space environment. This functioning prototype system design, and analysis of the drive assembly, including the supply of hardware, documentation, and test reports. The design features include a telescoping tube system. The threaded tubes are stored within each other. Using a motor and gearbox, the tubes are unscrewed, with the bottom tube always rotating. Inside the tubes, round telescoping tangs stop the top tube from rotating, as the top tube will be attached to the space structure. The telescoping mast drive assembly design combines both the mast and drive functions, thereby reducing overall system complexity and weight.

### **ALTAS: Audit Log Threat Analysis System for The Walt Disney Company**

*Harris Engineering Center, Table 7*

Modern software systems can generate gigabytes to terabytes of logs a day – almost 100 times the size of the entire Wikipedia database. Within this massive volume of data are anomalies created by potential hackers that can indicate malicious activity within a network. ALTAS is a software application in the cloud that detects threats on local computers to ensure client security without compromising privacy. Based in the cloud, this application is scalable, customizable, and extremely affordable.

## **University of Miami College of Engineering (Miami)**

### **Automated Cell Cluster (ACC) Quantification for Diabetes Research with MIN6 Spheroids**

*Harris Engineering Center Room 101, Table 27*

Novel ongoing research for diabetes treatment involves islet transplantation requiring islets of a certain size. Performing manual quantifications is time consuming and can introduce human error. This ACC quickly and precisely measures the size distribution of cell clusters, validated using MIN6 spheroids that model pancreatic islets used in diabetes research. The ACC quantifies the size distribution of multiple cell clusters samples at once using a user-friendly interface. A moving microscope exports images to a software which uses segmentation to analyze the data. Maximum size dimensions of 12”x12”x12” allows the system to fit in a laboratory setting. Clusters will be quantified in the range of 50 to 500  $\mu\text{m}$ . Functional requirements include: a minimum magnification of 4x, low cost in comparison to automated systems, and high precision to be less subjective, highly reproducible, and better-documented than manual counting.

## University of Miami College of Engineering (Miami)

### **Automatic Power Grip Exercise for Spinal Cord Injury Patients**

*Harris Engineering Center Room 101, Table 28*

Paralysis researchers need a way to objectively test a patient's motor skills and automatically record their progress with standardized and reproducible exercises. There is no known product on the market that provides an exercise for gross motor skills and which is able to automatically time and record progress. This device is a board with several indentations which the patient must place a cylinder into when a specific indentation lights up. Each indentation has a sensor that records reaction time from when the indentation lights up to when the cylinder is placed in it. A report is created indicating reaction times for the SCI research team to measure improvements in the patients and, in the future, to make modifications to their patients' routines. The device could also be used as an at-home device for gross motor skills improvement.

## University of North Florida

### College of Computing, Engineering & Construction (Jacksonville)

### **Strap-to-Wire Automated Welding System**

*Harris Engineering Center Courtyard, Table 145*

This team has automated a process in which a 20 AWG wire is spot welded to a small nickel strap. These high-volume components are used in smart battery packs to connect individual battery cells to circuit boards and other electronic components. This system will be used by technicians and engineers at Inspired Energy in Newberry, FL. The current welding process is performed manually and is time consuming. The automated system will allow 2-3 paid technicians to perform tasks other than spot welding, increasing company profitability and efficiency. *Discipline: Mechanical Engineering; Electrical Engineering*

### **La Esperanza's Drinking Water Distribution System**

*Engineering II Atrium, Table 73*

Sustainable, highly constructible, maintainable, and culturally acceptable system for the Guatemalan community. Its two 10,000 L tanks at the point of highest elevation in the system feed into four distribution lines to service every home and the school. Pressure relieving tanks were designed as the most cost effective and easiest maintained device to reduce pressures in the system due to mountainous terrain. Recommended water purification is the Solar Disinfection (SODIS) Method with the use of the Pentair Chlorinator in case of infectious outbreaks. *(Sponsored by the Society of Women Engineers)*

### **Automated Final Product Testing of a Peristaltic Pump**

*Engineering II Atrium, Table 62*

Stenner Pumps wishes to decrease the time it takes to test one of their pump models, the S-Series peristaltic pump. The current testing procedure involves a technician manually interacting with the pump by using the buttons on its keypad and reading feedback on its OLED display. This team has automated the process with a smart camera, a programmable logic controller, and small pneumatic cylinders. The camera is programmed to recognize various readouts expected on the OLED display of the pump. The PLC will receive information from the pump and from the smart camera. It will also control operation of the pneumatic cylinders that will be used to push the buttons on the keypad of the pump. Testing results will be provided via a small LCD. Automation enables the ability to test more pumps per unit time and reduces human error. The design template could be adjusted to work with other pump models. *Disciplines: Mechanical Engineering; Electrical Engineering*

**University of South Florida**  
College of Engineering (Tampa)

**Phytochemical Nanoparticles for Alzheimer’s Treatment & Preventive Care**

*Harris Engineering Center, Table 133*

This project proposes a nanoparticle-encapsulated product – containing cannabidiol, polyphenolic antioxidants and caffeine – for treating Alzheimer's Disease and its effects on patient behaviors. Research has shown that cannabidiol (CBD) from hemp and polyphenolic antioxidants (extracted from blueberries) improve cognitive functions in patients, and they have neuroprotective properties which may slow or halt disease progression. Caffeine, which has been shown to prevent Amyloid Beta protein production by antagonizing adenosine receptors in the brain, effectively shields neurons from disease-causing amyloid plaques. When encapsulated by polymeric nanoparticles, the three compounds can pass through the blood-brain barrier of patients in all stages of the disease, thereby halting pathogenesis, reversing neurodegeneration, and relieving behavioral and psychological symptoms of dementia.

*Discipline: Chemical Engineering*

**Mixed Reality C-130 Loadmaster Simulation for CAE USA**

*Harris Engineering Center, Table 14*

A mixed-reality model for a pre-existing simulation model. The simulation model is used for training military personnel for the role of C-130 aircraft Loadmaster, responsible for loading, securing, and deploying cargo from the aircraft. The new mixed reality model offers a realistic experience consisting of both a virtual world and real-world view. The real view is of instrumentation in a cockpit mock-up used by CAE for training of C-130 flight crew. Using modern technology such as the Unity graphics engine, HTC Vive virtual reality headset, Steam VR platform, and Zed Mini Camera, this mixed-reality simulation model provides a highly immersive and realistic training experience for its users. Virtual reality offers a greatly reduced training cost when compared to a training approach using a physical mock-up of a C-130 cargo bay.

*Disciplines: Computer Engineering; Computer Science*

