College of Engineering and Computer Science
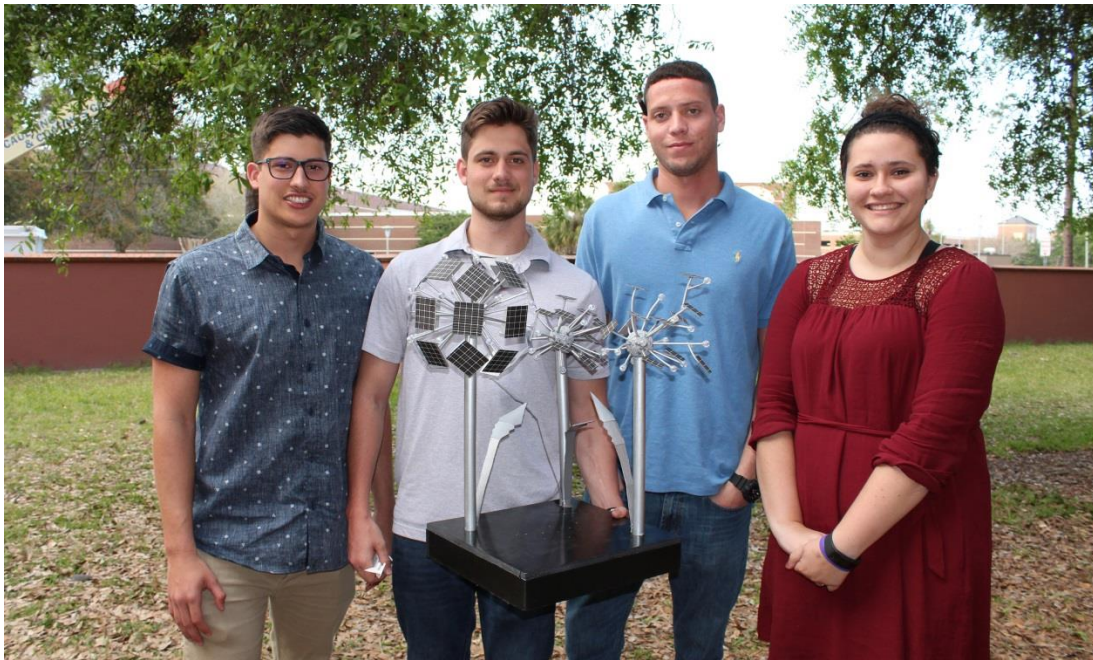UCF
UNIVERSITY OF CENTRAL FLORIDA

Spring 2017
Senior Design Showcase

Friday, April 21
8 a.m. to 4:30 p.m.
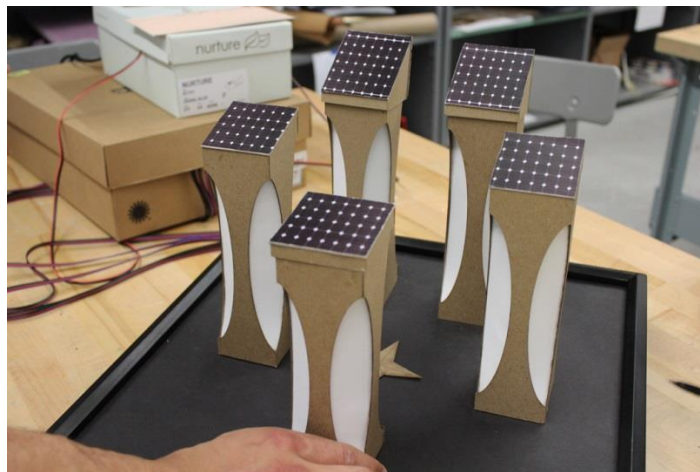Engineering II and Harris Engineering Center

"Dandelions" Solar Sculpture Project Sponsored by Orlando Utilities Commission

"Dandelions" Solar Sculpture Project
(Sponsor: Orlando Utilities Commission)

"High Five" Solar Sculpture Project
(Sponsor: Orlando Utilities Commission)

"Sun Dial" Solar Sculpture Project
(Sponsor: Orlando Utilities Commission)

Spring 2017
Senior Design Showcase

A showcase of more than 115 projects designed by 500+ graduating seniors of the UCF College of Engineering and Computer Science.

Projects will be showcased indoors and outside of the Harris Engineering Center and the Engineering II Atrium, in two sessions. See schedule below.

<u>Schedule</u>

8 a.m. – Noon
Mechanical and Aerospace Engineering; and Industrial Engineering and Management Systems

1 p.m. – 4:30 p.m.
Computer Science; and Electrical and Computer Engineering

5 p.m. – 6 p.m.
Judges' Awards Ceremony. Refreshments will be served.

MULTI-DISCIPLINARY PROJECTS

Solar Sculptures

Sponsored by the Orlando Utilities Commission, teams of senior-level undergraduate students in mechanical engineering, electrical and computer engineering, and computer science worked with UCF art students to create four aesthetically pleasing solar-powered sculpture designs. OUC's intent is to give the public an opportunity to learn about solar power – an important renewable energy source – by experiencing, enjoying and engaging with a beautiful, interactive community centerpiece sculpture and contribute to a local power grid.

The designs incorporate sound engineering principles, such as the ability to withstand hurricane force winds, and the ability to generate energy to power the sculptures' electrical features and contribute to the grid. The designs also use materials and convey art concepts – such as reflections and shadows – that consider being on display year-round outdoors in the bright sun.

The projects represent a culmination of work between the College of Engineering and Computer Science, and the School of Visual Arts and Design. Classes were held in SVAD's AdLab. During the spring semester, the four small-scale concepts were presented to OUC executives. One will be selected to be manufactured at full size (between 12 to 17 feet or taller) and then placed in a central public location within a Lake Nona-Orlando community. The selection will be announced on April 24.

Faculty:
Prof. Robert Hoekstra (CECS and SVAD); Prof. Robert Reedy (SVAD, AdLab); Prof. Mark Steiner (CECS, Mechanical and Aerospace Engineering); Associate Prof. Lei Wei (CECS, Dept. of Electrical and Computer Engineering); Prof. Mark Heinrich (CECS, Dept. of Computer Science)

"Dandelions" OUC Solar Sculpture

This team combined the Lake Nona community's rural past and technological future with an abstracted dandelion sculpture that conveys the area's agricultural roots and blossoming innovation. The dandelion was chosen because it is a simple yet strong and resilient plant. Natural dandelions use the sun to grow and bloom, while our engineered dandelions uses the sun to produce electricity and light up.

To some, a dandelion may look like only a pesky weed. But dandelions represent the whimsical nature of childhood and wishes. This endearing image was brought to life by animating the sculpture to mimic being blown in the wind. The sculpture engages people in a playful visual representation as the lights and energy move across and through the dandelions. By activating a pressure sensor, people can make wishes thanks to the giant dandelions dispersing light across the flowers. *(Harris Engineering Ctr, Outdoor, Table 66, 8 a.m. - 4 p.m.)*

"High Five" OUC Solar Sculpture

This team wanted to create a sense of immersion while still remaining a non-obstructive, open-air structure, focusing on the use of simple repeating shapes that symbolize unity and equality. They also wanted to subtly convey the message of solar-powered technology through the memories that the piece will create.

High Five contains five pillars standing tall and bright (at full scale the tallest pillar would stand 15 feet), collecting solar energy while displaying a dazzling array of LED-lit panels. During the day, the LEDs will be bright enough to see clearly, and the main structures of the piece will be shining steel in the sun. Each pillar is topped with a 49-deg angled solar panel to showcase how the sculpture is powered, and to maximize the efficient collection of sunlight.

Visitors can interact with the sculpture with its built-in motion and proximity sensors. Different people in different locations around and between the pillars will elicit a variety of light reactions. This is an aspect that can bring the community together and educate about solar energy. *(ENG II Atrium, Table 27, 8 a.m. - 4 p.m.)*

"Solar Kites" OUC Solar Sculpture
This team of first-semester senior design students wanted to start a conversation about solar energy by educating the viewer on the history of electricity and incorporating its future story with solar. At full scale, the sculpture would stand 17.8 feet tall, about the height of a typical two-story home. Reminiscent of Benjamin Franklin's discovery of electricity, the sculpture displays a key that, when stepped on, creates lights on the solar kites to represent the lightning strike that Franklin experienced The sculpture also incorporates recycled materials to add another layer of education to the project, showing how sustainability can be incorporated into our daily lives and how it is a bright part of our future. *(Harris Engineering Center, Outdoors, Table 67, 8 a.m. - 12 p.m.)*

"Sundial" OUC Solar Sculpture
As the Big Ben is a well-known monument in London, this team wanted a similar, modern, yet old clock tower designed specifically for the Lake Nona community. The idea of the sculpture is to represent how Lake Nona is traditional and community-oriented, and at the same time modern and new. This sculpture features interactive LED lights as well as interactive musical sounds. The sculpture will self-generate the energy it requires with solar panels. *(Harris Engineering Center, Outdoors, Table 65, 8 a.m. - 12 p.m.)*

Battlebots for Lockheed Martin
Three teams of mechanical engineering, electrical, computer engineering and computer science students were challenged to create remote-controlled ground robots that engage in warfare with the purpose of reducing human casualties. The projects are part of Lockheed Martin's Image Fusion Robot Competition. The robots can automatically detect targets (that contain pictures of human faces and enemy robots) to be fired upon using computer vision algorithms. The robots use lasers to gauge a target's range, and they also have aiming and firing capabilities with NERF blasters. On display are 3-foot partially interactive robots that demonstrate this emerging technology. *(Harris Engineering Center Atrium)*
Red Team *(Table 15);* Blue Team *(Table 13)*; Green Team *(Table 14)*

Tennis Automated Judging Project
All-in-one Auto-Ref scoring system engineered by Electrical Engineering, Computer Science, Computer Engineering students using high speed cameras and dynamic model path projection, automating the entire scoring and judging process for competitive and noncompetitive tennis matches. No fully automated system exists on the market. The project could potentially replace the chair umpire, line judges and ball boys/girls.

Also see the Tennis Automated Ball Retriever: Rolden Retriever, under Electrical and Computer Engineering. Together these projects are a step towards automating the game of tennis. *(HEC, Table 2)*

Glucose Optimal LED Detector (GOLD)
Computer Science, Electrical Engineering, Computer Engineering
Assists diabetics in measuring blood glucose levels non-invasively using a smart phone app that sends a signal to a hardware piece attached to the ear lobe, which sends near-infrared light through the skin and is picked up by a photodiode (a semiconductor that converts light into current, made of lenses and optical filters. The absorbance and light measurements are calculated by the app. A glucose concentration value is presented to the user. No more needle pricks, they simply clip on the earpiece.

An LED that shines a light at a certain frequency is either transmitted or reflected off of the user's skin and the glucose molecule reacts different that the water molecule so with this outcome in mind the result can distinguish if you have too much or not enough of the glucose molecule.

This device takes your pulse oximetry (oxygen in blood stream), your heart rate, your ear thickness and the glucose level in your blood and correlates these numbers with a phone app that tells you your glucose levels better and less expensively than the $500 system. *(ENG II Atrium, Table 18)*

MECHANICAL AND AEROSPACE ENGINEERING
(8 a.m. to noon)

Solar Adsorption Refrigeration
Refrigeration powered by the sun. A cooling effect is achieved without an electrically driven compressor. Instead an "adsorber" is used to harness solar energy during the day to drive the refrigeration cycle. These project are intended to improve upon current systems which have low cooling efficiency and therefore require large, costly designs to create desired cooling. *(Harris Engineering Center, Indoor)*
    Blue Team: ASHRAE – Integrated Sustainable Building Design Team *(Table 12)*
    Red Team: Design Calculations Team (*Table 3*)
    Green Team: ASHRAE – System Selection Team *(Table 2)*

Human Powered Vehicle Competition/ American Society of Mechanical Engineers
Human powered vehicles combine the sustainability of a bicycle and similar convenience and comfort of a car. The team intends to compete in four qualifiers: speed, innovation, obstacle and endurance challenges. The team's focus is to create a versatile vehicle that can compete in all four categories. This year's vehicle features a low center of gravity, a solar-powered Heads Up Display that gives relevant information such as speed, location) and line-of-sight driving. *(Not showcasing)*

CanSat International Design-Build Competition
Provides university students with the opportunity to create a mimics a satellite (payload) and a deployment mechanism (canister) that will take a myriad of telemetry data including heading, velocity, and air pressure as it descends through the atmosphere. *(ENG II Atrium)*
    Team 1: Mechanical and Structural Analysis (Blue) *(Table 18)*
    Team 2: Aerodynamics and Telemetry (Red) *(Table 19)*

Concentrated Solar Photovoltaics
A proof-of-concept project for residential applications. Using mirrors or reflectors to intensify the amount of solar radiation coming into a solar panel, thereby reducing the surface area and cost of PV material required for producing a given amount of electrical power. This project employs two highly reflective dishes to concentrate solar rays onto a small PV cell. They are constantly aimed toward the sun with dual-axis solar-tracking system. *(Harris Engineering Center, Outdoor, Table 64)*

American Institute for Aeronautics and Astronautics (AIAA) Design, Build, Fly Competition
Unmanned aerial vehicle must be capable of fully folding into a tube for transporting. When removed it must smoothly lock into flight configuration without manual assembly (all parts rotate or pivot into place). It also must be able to carry between 3 and 7 hockey pucks and safely fly. *(Harris Engineering Center)*
    Blue Team *(HEC, Indoor, Table 17)*
    Green (Test and Integration Team) *(HEC, Outdoor, Table 59)*
    Red (Mechanical Design) Team *(HEC, Outdoor, Table 60)*

Distributed Electric Propulsion
DEP employs many propellers that are placed at the front of an aircraft's wings. The design increases air speed and lift over the wing, allowing for a smaller wing, thus reducing drag and increasing cruising performance. This project integrates the concept into a small-scale drone. The reduced drag allows for longer flying time.

    Team 1 (Blue) *(HEC, Indoor, Table 7)*
    Team 2 (Green) *(HEC, Indoor, Table 8)*
    Team 3 (Red) *(HEC, Indoor, Table 6)*

MECHANICAL AND AEROSPACE ENGINEERING *(continued)*
(8 a.m. to noon)

Formula Society of Automotive Engineers KR17 Braking System
An international-level competition. This year's design focuses on the braking system to improve on previous systems which did not seem to distribute properly so the rear of the vehicle did not get the braking force needed. This year's design is an overhaul of the braking system within a limited budget. *(ENG II Atrium, Table 55)*

Florida Power & Light Robotics
Improves on a rover's previous design by decreasing total cost and weight, while vastly improving the utility. This design features a reinforced and waterproofed sheet metal body construction to allow for impacts. The body design is optimized for land and water travel, ideal for thick Florida swampland. The design has high-powered crawler motors for land use, and two high-powered propeller motors for water. Also features a camera system upgrade with 12x zoom lens.
    Team 1 (Blue) *(HEC, Outdoor, Table 61)*
    Team 2 (Green) *(HEC, Indoor, Table 4)*
    Team 3 (Red) *(HEC, Indoor, Table 5)*

Hybrid Rocket
Hybrid propulsion is an alternative to classic rocket propulsion methods of liquid-only or solid-only propellants. Hybrid technology has yet to be developed sufficiently for use in space but is widely used in amateur model rocketry. Teams set out to prove the viability using nitrous oxide gas to provide oxygen for paraffin wax to burn and power the rocket – still a novel idea. Rocket also features an air brake mechanism that will be deployed when the flight computer calculates the right conditions based on max desired altitude. Team 3's throttling system restarts after shutdown, which makes for an efficient flight and lighter rocket. Launched in Florida Space Grant Consortium's March 2017 competition.
    Team 1 (Blue) *(HEC, Indoor, Table 10)*
    Team 2 (Gold) *(HEC, Indoor, Table 11)*
    Team 3 (Green) *(HEC, Indoor, Table 16)*
    Team 4 (Red GOAT) *(ENG II Atrium, Table 21)*

Hydroridge
An attic ventilation system that is used to heat a home's water. The system consists of panels that attach along the top of a roof at the ridge that direct hot air from the attic over water-carrying tubes. The water-carrying tubes sit below a glass panel allowing the sun to heat the tubes and the water inside. The homeowner benefits from a cooler home and a lower-cost water heating method, which means reduced energy use. This system is designed to be lightweight, aesthetically pleasing on a home, and durable, and is a completely unique concept to the market.

    Blue Team *(ENG II Atrium, Table 22)*
    Green Team *(ENG II Atrium, Table 23)*
    Red Team *(HEC, Outdoor, Table 62)*

In-Situ Bop It!: Twist It, Pull It, Push It
Performing a material analysis on a large metal test specimen can be costly due to the process involved in making an individual sample. Scaling the process down to a microscopic level helps reduce the costs by allowing for 3D printing of each individual sample. The device can push, pull and twist these smaller test specimens while maintaining precise and accurate results. *(ENG II Atrium, Table 20)*

MECHANICAL AND AEROSPACE ENGINEERING *(continued)*
(8 a.m. to noon)

Micro-Unmanned Aerial Vehicle
Teams have developed micro-UAVs capable of achieving the highest payload-to-weight ratio while still remaining portable and containable within a packable case. Teams addressed factors such as speeding up manufacturing time, reducing cost, maximize payload weight, employ 3D printing and using lightweight materials. *(ENG II Atrium)*
> Team 1 (Blue) *(Table 24)*
> Team 2 (Green) *(Table 25)*
> Team 3 (Red) *(Table 26)*

ABB Roll-On-The-Floor Breakers
ABB manufactures high-voltage electrical switchgear systems. In the current models, the circuit breakers can only be removed from the switchgear compartment via the use of a hydraulic lift truck. This project aims to eliminate the lift truck and allow the breaker to roll on the floor independently. This will reduce inventory and maintenance costs. New designs include the addition of a drop-down leg and wheel assemblies. These designs will also be "arc flash resistant" to meet IEEE standards. *(ENG II Atrium)*
> Team 1 *(Table 29)*   Team 2 (Blue) *(Table 28)*   Team 3 (Red) *(Table 45)*

Agri-Starts Tissue Culture Lab Automation
The client is a family-owned and operated producer of plant starter plugs for customers in the agricultural community. Agri-Starts experiences a bottleneck during the media preparation phase, which can take as many as five technicians to complete the task of filling and capping a batch of trays (each containing 30 jars). To reduce labor costs while simultaneously increasing production, an automated tray handling, filling and jar capping solution was designed employing a U-shaped manufacturing line. It has three conveyors, filling and capping subassemblies, tray offloading table, and an integrated controls system. *(ENG II Atrium)*
> Team 1 (Blue: tray handling and controls) *(Table 33)*
> Team 2 (Green: capping) *(Table 32)*
> Team 3 (Red: filling) *(Table 34)*

Sea Turtles: Drones to Assist Tracking
To benefit the UCF Marine Turtle Research Group, the autonomous system assists biologists in locating clumps of seaweed where young sea turtles can be found. Monitoring the nests helps protect the turtle hatchlings and gain insight into their behavior. Three teams have been tasked with developing a device to provide researchers a bird's eye view of the ocean, while providing a sufficient aerial line of sight and prolonged flight time.
> Red Team *(ENG II Atrium, Table 36)*
> Blue Team *(ENG II Atrium, Table 31)*
> Green Team *(HEC, Outdoor, Table 63)*

U-Shaped Toothbrush for Disabled or Elderly
A toothbrush attachment for standard electric toothbrush handle, to assist people with motor function disabilities. A U-shaped track filled with bristles oscillate back and forth, enabling the user to simply insert the brush head into their mouth and have all teeth brushed simultaneously. *(ENG II Atrium, Table 54)*

Wheel Mill
Harnesses energy from a vehicle's wheel. With an alternator, it turns kinetic energy into electrical energy to directly power another device. Targeted to refrigerated trucks to allow a back-up power source in case the refrigeration system breaks, protecting temperature-sensitive items from spoiling. System attaches to vehicle's inner wheel, and will generate as much power as possible while minimizing energy loss. *(ENG II Atrium)*

> Blue Team *(Table 35)*   Green Team *(Table 44)*   Red Team *(Table 43)*

INDUSTRIAL ENGINEERING & MANAGEMENT SYSTEMS
(8 a.m. to Noon)

COMOPTEVFOR Test Plan Quality Improvement
Client: Commander Operational Test & Evaluation Force (U.S. Navy product testing organization)

The client is responsible for creating a test plan and then conducting tests to declare that products are field ready. They experience a high amount of late deliveries for their test plans. This team identified the cause of late deliveries and recommended solutions so that the client can execute test plans more precisely and see an improvement in the process. *(ENG II Atrium, Table 37)*

I-Con Stainless Steel Polish Improvements
Client: I-CON Fixtures
The client's manufacturing output capacity was hindered by a bottleneck in the grind and polish booths due to inefficient processes, backlogs, limited space, and more. This team proposed overall improvement of the grind and polish processes at the manufacturing facility by investigating current procedures, and collecting and analyzing relevant data. The team proposed improvements with the goal to: (a) reduce process times for polishing and grinding by 15 percent; (b) increase the capacity of the polishing and grinding process by 25 percent; (c) provide at least one creative solution for a continuous improvement effort outside the finishing booths; (d) bring process times under statistical control. *(ENG II Atrium, Table 38)*

Improvement of Manufacturing Process of Type I Turbidity Curtains
Client: Enviro-USA
Turbidity curtains are barriers used to isolate active construction areas from a body of water to control and contain silt, sediment and other pollution. This team used Six Sigma DMAIC framework and principles of Lean Manufacturing to recommend ways to reduce labor cost and excessive material handling currently involved. The team has proposed an alternative enhanced design of the manufacturing process flow. The objective is to allow Enviro-USA become competitive and gain market share in regards to the Type I turbidity curtain.
(ENG II Atrium, Table 39)

Glass Cell Study
Client: Boston Whaler
The study aims to create a data-based understanding of the defects that originate within the client's Glass Cell. The client will be provided a comprehensive report detailing study methodology, collected data sets for analysis and suggested corrective measures. *(ENG II Atrium, Table 40)*

I-CON Systems Flush Valve Assembly
Client: I-CON Fixtures
This project sought to help increase the efficiency of the client's flush valve assembly system for mass production. Those who have a small operation vs a mass operation will benefit from this project, and learn how to grow a business through increased production. *(ENG II Atrium, Table 41)*

AcCELLerate: A Charge On Consulting Process Improvement
Client: MC Assembly
The team focused on a designated assembly cell and a set of parts flowing through that cell during the project timeline. Team used a Lean Six Sigma Process to generate realistic baselines and improve process flow to ultimately improve process flow and strengthen scheduling capabilities. This team's methodology will solve the current problem and serve as a basis for future senior design teams that are tasked with solving similar problems in different areas of the client's facility. *(ENG II Atrium, Table 42)*

INDUSTRIAL ENGINEERING & MANAGEMENT SYSTEMS *(cont'd)*
(8 a.m. to Noon)

Monterey Mushrooms Facility Improvement
Client: Monterey Mushrooms Orlando Facility

This project aims to reduce the inefficiencies in the packing and shipping department of the farm without invoking additional expenditures by the company. *(ENG II Atrium, Table 50)*

Standardization and Layout Plan for New Kensington-Pen Hall Facility, Shipping & Receiving
Client: Siemens Energy

Two different facilities that supply service tools and equipment to the client's North America region are merging to improve efficiency and productivity in shipping and receiving. Allocating the right amount of space, time, and personnel for the new facility are key aspects that were addressed. The improvements in the system will increase productivity through the system which will reduce labor hours and costs. *(ENG II Atrium, Table 46)*

Improvement and Optimization Admission Process – Part 2
Client: Orlando Health

This team is completing a Lean Six Sigma project at Orlando Health's Emergency Department, focusing on triage and registration processes to identify inefficiencies. The team completed time studies and collected data on current processes and provided improvement suggestions based on their findings. *(ENG II Atrium, Table 47)*

Discrete-Event Simulations of the NASA Fuel Production Plant on Mars
Client: NASA

In NASA's preparation for a manned mission to Mars to test the sustainment of civilization, this research explored the requirements and feasibility of autonomously producing fuel on Mars for a return trip back to Earth. This team's work creates and analyzes the allocation of resources necessary in deploying a fuel station on this foreign soil. Previous research has addressed individual components of the mission, such as the power required for a fuel station and tools; however, the interaction between these components are still unknown.

By creating a baseline discrete-event simulation model using Simio software, the research team has been able to replicate the fuel production process on Mars. This research will mainly use the fuel component processing times, travel requirements, and In Situation Resource Utilization concepts to reach the end goal of producing enough fuel to safely get astronauts home. *(ENG II Atrium, Table 48)*

Improving Provider Referral Patterns and Outpatient Services
Client: Parrish Medical Center

This project defined and quantified the factors shaping the walk-in decision of customers entering the client's Outpatient Services Department. The team also sought to adjust the physician referral process based on the studied factors. The large number of walk-ins daily causes a large backlog in this area, leading to long wait times and ultimately patient satisfaction. Reducing patient wait time will ultimately lead to increased revenue. *(ENG II Atrium, Table 49)*

COMPUTER SCIENCE
(1 p.m. to 4:30 p.m.)

Parameter Discovery
For biochemists who use BioNetGen that allows for them to model biomedical systems. This is a parameter discovery tool to provide analysis on the results of different parameter sets that will be presented to the user so that they may perform some of their own analysis of which parameter set is the best. A website based, portable tool that researchers can use from any computer. *(ENG II Atrium, Table 36)*

Exercise at Home
An Android app and website meant to solve the issue of patients not following through with physical rehabilitation exercises. Also helps physical therapists with monitoring of exercise. *(ENG II Atrium, Table 37)*

Telepathy
Android app that helps users communicate more easily and discreetly. Users can have a conversation through their phone in a middle of a business meeting without anyone in the room noticing. Drivers could respond to messages, emails or calls without being distracted by looking at their phone. *(ENG II Atrium, Table 31)*

Automated Memristor Crossbar Synthesis (AMCS)
People can generate special circuits comprised of a relatively new technology, memristor crossbars. The circuits can be used in other disciplines such as computer vision or machine learning. Website: users submit a description of the circuit they want to create. The systems creates the circuit, tests it and makes it available to the user. Researchers who want to contribute or compare their circuit generation algorithms will enjoy the command-line tool and its codebase. *(ENG II Atrium, Table 38)*

Project Unity
A web application that allows the client's employees to track the amount of time they spend on certain projects and allows administrators to view those tracked hours and budget reports. Will enable viewing the relevant data in an easy-to-use environment. *(ENG II Atrium, Table 39)*

FCS VR (Virtual Reality)
Allows doctors to view high dimensional data in a virtual reality environment, to help doctors dealing with the data make decisions quicker. To be used by flow cytometry data analysts. *(ENG II Atrium, Table 40)*

Metagenomics Taxonomic Interference
When biology researchers attempt to understand bacteria in samples, the process can be tedious and riddled with complexities. This project is a single pipeline (MTI) that allows researchers to input sequenced DNA samples and find the bacteria present in those samples. MTI infers and visualizes relative abundance profiles of bacteria found in user-provided samples on a website or a local machine. *(ENG II Atrium, Table 41)*

Metagenomic Assembly and Analysis Pipeline
Helps genomics researchers with a straightforward way of evaluating and analyzing microbial metagenomic data (data that includes DNA sequence fragments from many different strains of microbes).
A web-based application runs several assemblers simultaneously, in a pipeline, on the metagenomics data file, parsing the different DNA fragments into a hopefully accurate representation of the complete DNA reference sequences of the microbes. *(ENG II Atrium, Table 33)*

Dynamic Radio Frequency Spectrum Map
Radio frequency detection across a large area is a complex problem that requires expensive equipment. This system detects radio frequencies that are in use, as well as the strength of each frequency using low-cost off-the-shelf hardware that collects data from multiple locations in combination with energy algorithms to create a dynamic RF spectrum map in real time. It stores snapshots of the data for archives. *(ENG II Atrium, Table 42)*

COMPUTER SCIENCE *(continued)*
(1 p.m. to 4:30 p.m.)

Cultural Virtual Reality Game
Uses Steam VR/Unity platform with Vive hardware to provide simulations of real-world socio-cultural experiences along with dialogue and choices made by users. No one has designed a game that lets you experience another culture and experience their language and customs in a virtual reality setting. Trains users on the language and the do's and don't's of traveling to a foreign country. Includes a website to view statistics of play, information about the project and downloading game files. *(ENG II Atrium, Table 43)*

Swish – Adapted "HORSE" Basketball game
Mobile basketball game based on the old –school game of H-O-R-S-E. One player attempts to make a shot and sends it off to player two, who attempts to recreate that same shot, before sending back one of their own, If a player fails to recreate a shot, they receive a letter from the word SWISH. When the player gets all five letters, they lose. Includes unique obstacles to add more creativity and challenge to the shots.
(ENG II Atrium, Table 44)

United Launch Alliance Scheduling Tool
Helps ULA with a variety of clients (NASA etc). Each of the different rocket types has different resource requirements per day, and different number of days depending on the mission. This project is a web application to store all of the resource requirements for each day of their mission types. ULA will be able to edit current missions, change the templates for future missions, or create new rocket types. *(ENG II Atrium, Table 45)*

NASA Mars Base Simulation
It has become clear that the success of a manned mission to Mars will depend on fuel components create on Mars' surface. This project is a simulation to provide initial insight into the operations of an autonomous fuel production on Mars. *(ENG II Atrium, Table 46)*

INGRID – INteractive GRaph Invariant Delimiter
Allows users (students or graph theorists) to obtain knowledge of abstract graphs by inputting a few elements of the graph. This project is a revitalization of the original program from the 1980s. Users can also draw their own graphs and extract information from it. This is the only program of its kind. Reduces time and energy needed by graph theorists to perform their job. *(ENG II Atrium, Table 34)*

Overlay
An augmented reality system that allows registered users to upload an image and 3D model on a website. Any user of the mobile app can then scan the image, causing the associated 3D model to appear on the image. The user can then rotate and rescale the model. Businesses can deploy augmented-reality-based advertisements in an easy-to-use manner. For example, a restaurant could have interactive menus for children, or a museum could have interactive exhibits with scan-able images. *(ENG II Atrium, Table 47)*

Topic Aware Gradebook with Assisted Targeting
Allows teachers to assign topics to each question in their assessments, then uses that data along with machine learning and problem solving to predict how well the student understands each topic. Teachers can better select topics to teach to the entire class, and which topics to focus on individual students. *(ENG II Atrium, Table 48)*

UniShop
Seeks to improve upon current e-commerce platforms by 1) never displaying users' personal information; 2) has user ratings (Facebook and Craigslist don't have). Also will include a built-in messaging system that will only be able to be enacted once a buyer and seller complete our built-in "hand-shake" process. The only other forms of communication will come from our question and answer system. *(ENG II Atrium, Table 50)*

COMPUTER SCIENCE *(continued)*
(1 p.m. to 4:30 p.m.)

Quest!
This platform seeks to revolutionize odd jobs into a unique experience for all participants. It enables Quest-givers (Hosts of Jobs) to find and connect with Questers (Job Seekers). The innovation is not in the idea, but in the implementation: by operating in the same manner as a traditional role-playing game. The playfulness of the presentation of the task is seen not as a laborious chore but an "epic journey" filled with risk and challenges. There is no haggling or discussion on reward for a quest. The Quester knows that if he or she completes a quest with a reward attached, then that is the reward they will receive. Better than Craigslist because of the game philosophy and connecting people. *(ENG II Atrium, Table 49)*

KDispatch
Allows transport brokers to efficiently communicate with their leads and truckers as easy as possible throughout the entire transport process. A set of two independent pieces of software work together and communicate with each other. Transport brokers use a web application to easily manipulate and carry out tasks on their leads. The leads are converted into orders where they are sent to the group's other software, a load board. Hosted in the cloud, the software includes a web and mobile application. *(ENG II Atrium, Table 51)*

MotionDetect
Enables Raspberry Pi users to turn their Pi into a security camera system with motion and facial detection. Once a human face is detected the user will receive a notification from their Android device and email account. The camera will save the video of the motion detected so the user will view exactly what was going on when the Pi detected the motion. Users may change the days and times to receive notifications in both applications. *(ENG II Atrium, Table 35)*

Streamr
A web application that enables educators to draw on virtual lecture canvas before an audience of students. It's designed and produced with educators in mind, but is intended for amateur use. One of the hardest things about creating high-quality, online educational content is the production aspect. Using our platform, presenters will be able to create, broadcast, and revisit high-quality educational productions with ease. Every stream will have a crisp appearance without the presenter needing to do anything but deliver content. *(ENG II Atrium, Table 52)*

Streamline Drafting
Web and mobile app designed to assist fantasy football players with drafting experience. Streamline Drafting aggregates all of the necessary information to expertly draft a team with the ease of being all in one location. A user simply enter how many teams are participating in the draft along with what position they will be drafting in. Application informs users on injury status, depth chart position, previous seasons stats and projections of the upcoming season's stats. When a user completes a draft they can save that team, which they will be able to manage throughout the season. *(ENG II Atrium, Table 53)*

3D Unity Scanner
The goal of this plugin is to assist student and indie game developers by expediting and increasing accessibility of the level prototyping process in Unity. *(ENG II Atrium, Table 54)*

Internet of Things Security
The software developed provided automatic monitoring of connected IOT devices, alerting users in the event of a compromise and providing general information about current activity. the software provides a higher level of focus and fidelity than existing network protection solutions in the realm of IOT devices. *(ENG II Atrium, Table 55)*

ELECTRICAL AND COMPUTER ENGINEERING
(1 p.m. to 4:30 p.m.)

G12 Pedal Vision
Combines the warm natural tones of analog effects with the versatility of digital effects. Portable and cost effective. Most commercial products only contain a single analog effect, or are high priced digital effect boxes that don't allow for programming. Intuitive user interface, LED matrix to display sound output.
(Harris Engineering Center, Indoor, Table 3)

Rolden Retriever
A robot capable of detecting a tennis ball on the ground, picking it up and bringing it back. Tennis players of all skill levels can benefit from spending more time playing and less time fetching stray balls. Rolden navigates autonomously and avoids objects using a 360 degree LIDAR scanner. *(HEC, Indoor, Table 1)*

Automated Vehicle Anti-Theft Security System
Intended to deter vehicle break-ins, thefts and damage. Surveillance system attaches to vehicle roof and provides a visual of each side through four cameras. Also has motion detection sensor. User can view a live video feed of each camera as well as past footage and will be notified via an Android app of any security triggers. Powered by a sealed lead acid battery charged by a solar panel. *(Harris Engineering Center, Outdoor, Table 58)*

Knight Guard
Hidden from attackers, the small device will incapacitate the attacker when activated. Can be used with little motion from the victim, even if their hands are tied. *(ENG II Atrium, Table 19)*

Low-Shift Raman Microscope Attachment
Made for a chemistry professor for detection of low-shift Raman spectra, which has applications in forensic science as a way to identify drugs, explosives, and forged documents. Current systems on the market are expensive and bulky. This lower-cost alternative can fit on a table in a chemistry lab.
(Harris Engineering Center, Indoor, Table 7)

Home Hydroponic System
Self-contained system that allows users to grow vegetables with minimal effort. The system will check and adjust the pH and nutrients; monitor water level; turn on or dim lighting system; controlled from the internet; alert and allow use with a smart phone app. *(HEC, Indoor, Table 4)*

Smart Digital Voltmeter
Measures AC or DC voltages and presents the data to the user with an LCD display on the device and also a smart phone app. Users can store data as a text file or screen shot saved directly onto the phone. Most voltmeters available require the user to manually record the data or have multiple people measuring and recording data. This portable, low-cost solution is easily manageable in the field. *(HEC, Indoor, Table 6)*

3D Glass Laser Etching System
System with three motors mounted to form an x-axis and z-axis. Its electrical subsystem is assembled and programmed to move the motors in positions according to the image file via a graphical user interface. Subsystem has mirrors, lenses, polarizer, and quarter-wave-plate. This design improves upon sponsor's 10-year-old outdated laser etcher that can simultaneously etch up to six glass engravings. With safety in mind, the system is placed in a protective casing to prevent physical interaction during use. *(HEC, Indoor, Table 5)*

ELECTRICAL AND COMPUTER ENGINEERING *(continued)*
(1 p.m. to 4:30 p.m.)

Smart-Phone Controlled Solar-Powered Flower Art Display
This aesthetically pleasing project's 12 petals can illuminate with multicolored LEDs based on the input received by the smart phone app. Can be used as a two-hand clock, a lamp, or it can show a pattern for festive events. The flower head is connected to a base which holds the solar cells on its outside, and houses a programmable microcontroller with a battery power supply. *(HEC, Outdoor, Table 60)*

Smart Helmet
A proximity sensor attachment that can be added to a motorcycle helmet. Alerts users when an approaching vehicle is in their blind spot when the rider uses their turn signal. Uses sensors to record data readings and two microcontrollers that communicate via Bluetooth. Less costly than previous models. *(HEC, Indoor, Table 8)*

Military Surveillance Robotic Vehicle
Lightweight, voice-controlled autonomous robotic vehicle that can be used in ground surveillance and tracking. Takes voice commands with user's mobile device and carries out the command, such as "survey" and "track." Also features a camera feed so the user can see what the robot is seeing. *(HEC, Indoor, Table 9)*

Optical Supplemental Navigation Device to Help Visually Impaired
Brings confidence to the visually impaired. A rangefinder gives the user an idea of where unknown obstacles and openings are beyond the range of a cane or guide dog, using a laser detector. Other similar products use ultrasonic technology. The laser is more affordable and give a more precise reading. *(HEC, Indoor, Table 10)*

The QwikBox
A live upload box to be used when recording sporting events. It features easy-to-use controls via a mobile app and Bluetooth. The user connects the device to a camera and starts recording. QwikBox then begins streaming video feed to a remote server, which receives the stream and encodes the video to a smaller format to save server space while retaining HD video quality. The advantage of QwikBox is the lower cost by passing along the heavy computing power to a remote server. Battery can last 10 hours. *(HEC, Indoor, Table 12)*

Solar Bike
Electric bicycles are increasing in popularity as people turn to alternative modes of transportation. Most e-bikes cost thousands of dollars and are inefficient and bulky. This is a solar-integrated e-bike with a significantly lower cost. *(Harris Engineering Center, Outdoor, Table 59)*

PLUTO (Picosecond Laser Ultrafast Target Observation)
This picosecond laser diode transmitter has been designed to perform time-of-flight calculations, a technique used in LIDAR. Part of a research project which will require the use of a picosecond diode laser with an adjustable phase to pump a high-energy ultrafast laser system. By using the laser to illuminate the target, the scattered signal will be measured with avalanche photodiodes. Time-of-flight calculations from the measured signal will determine the distance of the object with a resolution finer than a centimeter. The information will be displayed in a LabVIEW interface. *(Harris Engineering Center, Indoor, Table 16)*

Analog-Digital Hybrid Synthesizer
An electronic musical instrument at its core, this synthesizer will provide users with classic analog synthesizer sound that includes the benefits of digital control and MIDI capability. It significantly reduces the cost of traditional analog synthesizers and provides the ability to experiment and create unique music.
(Harris Engineering Center, Indoor, Table 17)

ELECTRICAL AND COMPUTER ENGINEERING *(continued)*
(1 p.m. to 4:30 p.m.)

Protein and DNA Qualification
A low-budget solution to allow the study of proteins and genetic information using spectrophotometry (the use of light to acquire properties of a chemical or substance). Provides researchers with a quick and easy solution to running spectroscopic protocols, without significantly impacting workflow or lab efficiency. Uses a modern display screen and a more powerful processor to enable real-time graph generation. *(HEC Indoor Table 11)*

DeepGate
Power-efficient machine learning. Hardware-accelerated speech recognition using FPGAs, for use in data centers, or companies that need power-efficient, reconfigurable hardware capable of machine learning. It works with specially designed digital logic tuned for matrix multiplication. Possible applications include speech recognition, image classification or search engine algorithms. *(ENG II Atrium, Table 23)*

Portable Finish Line Data Capture System for Sprinters
Provides sprinters of all skill levels a low-cost, portable and precise timing instrument that is easily controlled with a smart phone. Using a microcontroller with Bluetooth and Wifi capability, sprints can be timed with more accuracy than a stopwatch. The app also allows users to track their progress. *(ENG II Atrium, Table 20)*

Breathalock
A breath analysis device that acts as a keyless entry FOB. If driver's sobriety is verified, it will unlock the car. If the driver shows a blood alcohol level above legal limit, the car will not unlock. *(ENG II Atrium, Table 21)*

Truck Smart
A sensor-based system that will alert truck drivers in real time of other cars, pedestrians, bicycles and more within close proximity of the truck. Using range sensors to detect objects in blind spots, that sends data wirelessly to a display inside truck cabin. There are currently no blind spot detection systems on the market intended for large trucks. *(ENG II Atrium, Table 22)*

Heterogeneous Automotive Response Apparatus Made for Broad Emergencies
System instantaneously sends a signal (message and call) to a pre-determined emergency contact list, and emergency services when a car crash is detected. Uses on-board diagnostics to obtain car information to detect a crash as accurately as possible. A microcontroller with gather the data and detect the crash, and if detected, a signal via Bluetooth will be send to Android apps of the driver's friends and family, and emergency services to ensure that help can get to the accident scene in a timely manner. *(ENG II Atrium, Table 24)*

Smart Table
An LED signage display that is integrated into a common piece of furniture. A coffee table, for example, could have entertaining patterns or games while preserving the look and functionality of a traditional piece of furniture. *(ENG II Atrium, Table 26)*

Project E.A.S.I.: Electronic Assistant for the Sight Impaired
Smart device senses distance and provides feedback through tactile and audio systems. Includes a battery charging system to provide power for daily use and then is recharged overnight. Employs an array of proximity sensors to provide distance data. The controller will process all of the inputs and provide intelligent outputs to the user (either tactile or audio). User can turn on or off the audio. *(ENG II Atrium, Table 25)*

ELECTRICAL AND COMPUTER ENGINEERING *(continued)*
(1 p.m. to 4:30 p.m.)

Pocket Amp
A portable battery powered guitar amplifier for musicians on the go. The output of the Pocket Amp is a standardized headphone output allowing musicians to supply their own speaker or headphones. Also features an easy-to-use Android app interface. *(ENG II Atrium, Table 28)*

F.L.O.W. (Fun Low-power Observer-interactive Waterfall)
Designed as a fun add-on to a solar sculpture, to attract attention to the sculpture and entertain observers. The system observes user motion through optical sensors and allows users to control the output of a series of graphical water solenoids and variable brightness LEDs. The system allows for administrator control of displays such as designs or words. *(ENG II Atrium, Table 29)*

Laboratory Control System
Designed for an engineering cleanroom to provide access control to individual pieces of equipment, which creates accountability and improves the billing process efficiency. Features include: expandability, access control, online reservation system, administrative control, and ease-of-use. Intended to help the process of scheduling a machine, a problem currently faced by students and professors. *(ENG II Atrium, Table 30)*

Smart Mirror
Designed to provide the user with informational updates such as weather, news, and social media feeds while using the mirror. Features gesture input, dynamic LED lighting, and face recognition login.
(ENG II Atrium, Table 32)