

Spring 2021 Senior Design Virtual Showcase

April 20-23, 2021

Featuring 171 engineering and computer science projects designed by collaborative teams of nearly 900 graduating seniors of the UCF College of Engineering and Computer Science.

See videos of all team projects on our [Senior Design Virtual Showcase website](https://cecs.ucf.edu/SeniorDesignShowcase/showcase)
cecs.ucf.edu/SeniorDesignShowcase/showcase

More than 170 UCF alumni judges – who are engineering and computer science professionals – will score the projects on a variety of metrics, provide qualitative feedback to the teams, and decide the best in each discipline and Best in Show.

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Interdisciplinary Projects

ANVIS: Automotive Night Vision Imaging System

Computer Science, Computer Engineering, Electrical Engineering, Photonics

An augmented reality heads-up display or “HUD” that enhances a driver’s vision in low visibility conditions. A camera captures images of the road, including blind spots, which are enhanced with algorithms developed by the team. Images are projected on the windshield. Can be used hands-free, as system has voice recognition capability.

Smart Table

Electrical Engineering, Photonics

A multifaceted entertainment and information system controlled from a single device and screen. Multiple interconnected devices are embedded into a coffee-table sized surface. Features an HDMI port, an audio system, a USB type 3 charging station, a projector that can be aimed at the wall or projector screen, a fingerprint secured lockbox as well as dynamic LED lighting, controlled via phone app. Can be used for meetings or presentations.

Color Acquisition Device

Electrical Engineering, Photonics

Using a high-powered laser to generate multiple wavelengths via stimulated Raman scattering, this team attempted to characterize and classify objects based on their spectral reflectivity, by looking at the different shape of the wavelengths in time. Wavelengths generated by stimulated Raman scattering makes it possible to distinguish objects without using diffractive elements to separate the light waves in space. This reduces the overall size and bulkiness, while also introducing a level of simplicity.

Smart Window

Computer Engineering, Electrical Engineering, Photonics

Mounted on an actual window, the Smart Window gives accurate weather information with a robust set of onboard sensors and WIFI connectivity. The time, calendar and weather information displays when the user approaches. Also serves as a personal assistant with companion mobile app, and can display your personal calendar events. Toggle between transparent and opaque views.

EDADS: Enhanced Driver Awareness Detection System

Computer Engineering, Electrical Engineering, Photonics

A solution for safer off-road navigation. This system provides a cheaper, more customizable navigation system than current systems on the market. Compact size, easy to integrate into a vehicle, EDADS offers features such as battery voltage and tire temperature monitoring along with being very easily implemented into a vehicle. Aimed at off-road sport driving but can be used in any vehicle.

Lunar Exploration Using Augmented Reality for NASA SUITS Competition

Computer Engineering, Electrical Engineering, Photonics

Software for an Augmented Reality helmet that helps an astronaut with navigation, lighting, and geological sample taking. Currently there is no visual display in the helmets, as NASA is working with partners to create the hardware. The software allows for increased interaction between the task needed and the user, which results in higher proficiency in task performance.

Interdisciplinary projects continued

Autonomous Smart Window

Computer Engineering, Electrical Engineering, Photonics

Can be controlled with a smartphone and features a variable tinting function to select the amount of light transmitted through the window; a privacy screen that toggles between opaque or a frosted appearance, which can be scheduled; a system of sensors that constantly monitors the outside environment to allow for fully autonomous operation; and a color-varying LED system. Security mode engages privacy screen; and eco-mode manages tint level throughout the day to limit sunlight and heat.

Autonomous Pet Entertainment System

Computer Engineering, Electrical Engineering, Photonics

Features advanced laser technology to entertain pets and navigate through most indoor environments. The self-driving entertainment platform uses a camera to track the pet and keep a laser pointer away from it along with navigational sensors to avoid obstacles while moving about a room. This system was designed by combining technologies from multiple pet toys on the market

Closed Marine Life Support System

Computer Engineering, Electrical Engineering, Photonics

A prototype sensor suite designed to study aquatic life in micro-gravity environments. This NASA-funded project will measure critical parameters related to water quality – dissolved oxygen, salinity, temperature, ammonia, algae color, and turbidity. System is equipped with transceiver electronics that will transmit data. Scientists can study how aquatic ecosystems react to micro-gravity environments.

Expressive Laser Harp

Computer Engineering, Electrical Engineering, Photonics

A musical instrument that uses laser “strings” and infrared distance sensors to create an expressive, versatile MIDI controller. For all skill levels, it can be used for live performance or for music creation. Unique because of its infrared distance sensors, which detect the distance at which a laser “string” is being blocked, offering a programmable expression similar to aftertouch on a keyboard controller.

Turtle Tracking II Database Development

Computer Science, Industrial Engineering

An update to the UCF Marine Turtle Research Group’s database and website to improve efficiency in reporting data and conducting studies. Last year’s team started the transition from the previous database and this year’s team is finalizing the application. The latest iteration uses a React Website, Flask API, and an AWS Postgres Database. Any new formats required by the state and any institution that requires information from MTRG can be serviced all at a low-cost system hosted on AWS. During the database development, the industrial engineers helped the computer science team with finding bugs and creating a training program for the website. Quality engineering techniques were used to allow client to implement the database completely and ensure the database is intuitive and user-friendly.

Themed Entertainment Mechatronics

Computer Science, Mechanical Engineering

An animated robotic figure that can move through a crowd, speak to guests and react to its environment. Typical animated figures are permanent fixtures that perform a singular animated sequence. This figure can perform a wide variety of animations, selected by a performer in real-time. The performer can speak to guests as the figure’s character via two-way audio. Comprised of a mobile wheeled base, a rotating torso, two articulated arms, a neck that tilts in multiple directions, a head with moving eyebrows and two LED matrix panel eyes.

Computer Science

Safeplan – A Youth Suicide Prevention App

A digital safety plan that provides an alternative to paper-based or verbal safety plans. Cannot be lost, is easily accessible, and can change in response to usage and feedback. It allows for a youth to track and share various metrics of progress and create a support network of people and resources that they can contact from the app. An encouraging and interactive tool to help suicidal youths stay safe.

Verifying Quotations for the Johnson’s Dictionary Online Project

The effort to digitize Samuel Johnson’s *A Dictionary of the English Language*, an 18th-century dictionary that gives quoted examples of defined words to provide context, requires a painstaking process of quotation source verification. This team collected historical texts from various sources such as Project Gutenberg and the Library of Congress using custom-tailored web scrapers; and used a powerful fuzzy search algorithm with the aggregated data to search through historical texts to find the top-five most likely source matches for each quote. The algorithm is designed specifically for *Johnson’s Dictionary* to work with Samuel Johnson’s text, title, and author abbreviations for the most accurate source matches possible, which are automatically evaluated and graded by the algorithm. Project includes a web interface tool.

Seedlings: Teaching Programming through Video Games

A video game to help teach younger children programming concepts without textbooks or other materials. Run on a homebrewed Nintendo 2DS or 3DS, the game can be used by educators, parents, or students who would like to get themselves into the computer science field. Compared to textbook learning, the game is hands-on and more engaging to the user. Features a standalone learning experience so that a teacher’s guidance is not needed.

PELT 2.0: Plume Ejecta Lunar Tools

Communicates what’s happening on and around the moon when a spacecraft lands, with a focus on the dust, sand, and rocks that get ejected in the process. PELT 2.0 provides a visual simulation created within Unity that can be used either as standalone application or a WebGL version on a website. Currently simulations can be run on supercomputers that output text-based information about particle position. This text information is imputed into a separate graphing system to visualize moments in 3D space. These moments are static and do not allow for more analytics to be performed outside of simple derivations of physics equations. With PELT the simulation and visualization are combined into a single system that allows for more in-depth analytics of the simulation. No similar tool exists.

RE-RASSOR: Research & Education Regolith Advanced Surface Systems Operations Robot (Black Team)

RE-RASSOR is an emulation of NASA’s proprietary RASSOR robot, which is designed to mine and excavate regolith (loose sediment or soil) on the moon. The Black Team’s primary goal is to implement object detection, autonomous navigation, and control software onto a physical rover. RE-RASSOR’s goal is to recreate the software and hardware used on RASSOR in a way that educators, students, researchers, and hobbyists can openly use and contribute to it. Legacy software has already been written for the simulation. This team was tasked with testing and verifying the software in a live setting. Will be given to Kennedy Space Center for further research and development.

RE-RASSOR: Research & Education Regolith Advanced Surface Systems Operations Robot (Gold Team)

RE-RASSOR is an emulation of NASA's proprietary RASSOR robot, which is designed to mine and excavate regolith (loose sediment or soil) on the moon, as an autonomous way to start a lunar colony. An education tool for use in classrooms, and act as an emulation of the much more sophisticated NASA RASSORs, with similar functionality, but are composed of popular hobbyist hardware.

Augmented Reality for Flairr App

Provides a multiplayer game experience by connecting players to a multi-player room and launching an augmented reality environment while synchronizing different aspects of the environment. Most AR games are not real-time multiplayer, so players are not directly interacting in the space. The main deliverables are several Multiplayer Augmented Reality Minigames called missions, each with unique gameplay and multiplayer implementation.

Artificial Intelligence for Flairr App

Provides the Artificial Intelligence backbone to FLAIRR (a multiplayer social AR game), being developed by the XI Media Labs Team. It allows gamers to play a detective and mystery game in a real-world environment. The team worked on: location classification; object recognition on the phone's camera; detection of inappropriate content; smart matching of users; and providing a sample application for live integration to test the features. These features will add a sophisticated touch of AI to the FLAIRR application that allows players to interact with the game and their environment in a fun and new way.

2+ Community: Measuring Place

The 2+ Community mobile phone app makes the development of public spaces more community-driven using community-focused data early in the process. Researchers can use the app to measure the qualities of existing places and attain a better understanding of their condition. They can form research teams and organize activities to measure public activity within, and public opinion about, these places. It will provide a simple and intuitive interface to make gathering this data easier and more streamlined than using a notebook or clipboard.

2+ Community: "Enhancement of Place" Mobile App for Placemaking Pipeline

A mobile app with a web component that can bridge the gap between architectural design and placemaking. People can preview proposed architectural projects with augmented reality and leave feedback. Architects and city officials can involve the public in a dynamic and streamlined way. Architects can upload 3D model bundles and survey questions via a website. The app serves as a practical tool for gathering community feedback on a proposed project prior to building it, thus including the public on the design of an area that is meaningful to them in a fun and engaging way. No similar app exists.

New Automated Testing Environment for U.S. Military's Persistent Cyber Training Environment (Black Team)

A runtime environment where UCF testers of the Persistent Cyber Training Environment can schedule their test cases to run automatically overnight and view results the next day. Currently, testers are using Katalon Studio to automatically run their test cases, but due to recent changes regarding their switch from open-source to commercial licensing and loss of certain software integrations, they have requested an automated testing environment to replace Katalon Studio. Testers can incorporate this project within the testing pipeline quickly and smoothly while using their own scalable software that does not require a paid license to use. Sponsored by the U.S. Army's PEO STRI.

Data Aggregation and Training Analysis Dashboard

A solution for the Special Warfare Center at Fort Bragg, NC, which has 3100+ students and 40+ courses to train soldiers in special operations. This project tracks a student's progress through their courses until graduation. This allows questions such as: What is the pass rate for this course? How many students are expected to graduate? How many students failed? to be quickly answered. Currently the data is disorganized, making it difficult to glean useful information from it. This application imports the data from Excel files and generates a dashboard that has a useful statistics and charts, saving hours of processing time.

SeeShells Version 2

A commonly used program that retrieves information from Microsoft's Windows operating system known as ShellBags contains essential information about user actions that can be used by digital forensic investigators and analysts. SeeShells works by parsing the information stored in the Windows Registry, converting it into a human-readable format, displaying the evidence for the user. Version 2 provides improved parsing performance and coverage, expanded import/export functionality, and enhanced user interface by providing multiple views/displays to the user. An open-source tool for use in the cyber security community where enthusiasts, researchers, and digital forensic analysts can use this tool to aide themselves in an investigation.

Fortuna v2: Web-based Combat Strategy Game

An autonomous robot combat simulator based on Dr. Richard Leinecker's book *The Birth of Jai*. This web game teaches programming concepts using the scratch-based coding editor Casus. Different users can build and program their tanks to deterministically battle in a competitive arena style combat. Players can use the marketplace to purchase upgrades, equipment, and Casus code modules with in-game currency. Fortuna Version 2 aims to overhaul the entire website by improving: Security Improvements, Visual Redesign, New Player Experience, and Game Improvements.

Website for Schillinger System of Musical Composition

The Schillinger System is an extensive method for describing, analyzing, and composing music by Joseph Schillinger. This team has created a way to make this unique perspective on music theory more easily accessible with a website and a web application that works like a digital book, with source text and audio, visual, and interactive examples. The website contains an applet that generates music in accordance with Schillinger's methods and allows the user to control music generation and listen to it. Intended for musicians and software developers.

Automated Electronic Dance Music Composition

Aids in the creation of original electronic music scores by automatically generating rhythms and melodies based on user preferences. An additional web application allows users to share and discover compositions that were created using the program. The software uses artificial intelligence to generate various compositions which are then rated by the user. The user's favorite compositions are then recombined to create a new set of compositions. This project is unique as other music generation software creates music based only on genre without taking the user's preferences into account.

String Verification in Open Java Modelling Language

OpenJML is a friendly tool for a programmer to verify their code with current SMT solvers. This project adds a means to verify that a program using strings is working correctly through OpenJML. Intended for programmers working on mission-critical software to provide assurance. OpenJML works by annotating code with java comments, translating these annotations to a form that solvers understand, and handing the translated annotations to a backend solver that can verify that the program is behaving as it should.

Training Reinforcement Learning Agents for Lockheed Martin’s “Everglades” Environment (Black Team)

Designed to compete against other non-human agents in Lockheed Martin’s turn-based strategy game “Everglades.” This team used and implemented a variety of reinforcement learning techniques while attempting to achieve the highest win rates possible in the environment. The overall goal is to test the “Everglades” game and determine winning strategies to produce a set of benchmarks that future teams can compare their results against. This team hopes to encourage future open-source reinforcement learning research on “Everglades” through its benchmarks and examples, as well as compiling a list of potential problems that may be encountered during training.

AI/RL Battle Bots for Lockheed Martin’s “Everglades” (Gold Team)

“Everglades,” a two-player game environment created by Lockheed Martin, involves players navigating their Battles Bots on a map to gain points and capture nodes. This team created reinforcement learning AI that can learn how to play in this environment by training it against various other agents. They built upon previous work to create an AI that can obtain a higher win-rate than its predecessors. Sponsor will get a better understanding of what positions are favorable and unfavorable for a player. This agent will also help game designers insights into the mechanics of the game.

Agent Behavior Research and Analysis of StarCraft 2 in Lockheed Martin’s “Everglades”

This project is intended to set the baseline for accurate analysis of RTS (Real-Time Strategy) data that is used to learn and infer better strategies for the future. Since the actual Everglades game is still in production, current analytics are being conducted on StarCraft 2 which at the core is similar to the mechanics of Everglades. These analytical practices and modeling methods are intended to be viable in the completed version of the Everglades game.

“Everglades” Game Development for Reinforcement Learning for Lockheed Martin

This team’s main goal was to extend the functionality of a pre-existing codebase that will be used as a platform for artificial intelligence training. The video game involves two artificial intelligent agents that face one another on a map, taking turns to move their units around to take control of the gameboard. The game is intended to help new Lockheed Martin employees better understand artificial intelligence, how it learns, and how it can be used. The project works by running the game inside a server. The processes are visualized graphically in an external, third-party program. This project is tailor-made and allows for more control over outcomes and desired specifications.

Computron 2.0: Expanding Gameplay of an Educational Computer Science Video Game

Teaches fundamental computer science concepts to beginner programmers. Players can intuitively explore computational logic by creating code-like solutions to puzzles through computer instruction cards performed by an in-game character. It coaches players to think like a programmer and connect abstract programming concepts to their concrete effects on a simulated machine without the complexity of learning traditional code syntax. Expands the original game with new instructions and levels, an in-game rewards system, and improved tutorials. A level creator mode and online gameplay make the code puzzle creation accessible. Developed with Unity game engine, can be used on PC and mobile devices.

Medicine Tracking for the U.S. Army

A medicine and supply tracking system for the U.S. Army to track deliveries between a medical logistics company and the final recipient, often stationed in remote locations. The sender at the MLC can receive a copy of the order request at the same time the supplier does. The sender can update the system the time and date the product arrived from the supplier, and when it gets shipped to the remote location. This will inform the receiver that their product is on the way. Once the product arrives at the base, this system will update the product status so that the receiver and the sender will see that the product arrived safely.

Reality Flow 2.0: Real-Time Mixed Reality Content Prototyping Tool

Aspiring developers can rapidly develop or prototype virtual reality and augmented reality software with other users, without knowledge of traditional programming languages. The tool uses an easy-to-understand and easy-to-use graph-based interface that can “program” functionality into 3-D objects. To connect to a server, users first register an account through any of the Reality Flow desktop, mobile, virtual reality, or augmented reality clients, then create and edit objects within a 3-D environment. Changes made to objects within the project are visible in real-time to all other connected users, and only one user can edit one object at a time through a check-in and check-out system.

CodeFeel: A Program to Assist Coding Instructors

CodeFeel grades coding assignments, and provides the instructor analysis of a student’s difficulty areas. It also provides instructors a way to create assignments, rubrics and test cases. For students, CodeFeel gives assignment results immediately and provides suggestions on the spot. Geared toward Unity and Python assignments. CodeFeel is a Unity and Visual Studio Code (VSC) extension, with a server being hosted on Linode. A GitHub account is required as the assignments being turned in will be submitted through GitHub repositories. It has two interfaces: one for students, and one for instructors. Convenient and accessible within the same window as the coding activity

Deep Mozart

Enables users to compose new music in the style of the great composers of the past using state-of-the-art artificial intelligence research. Previous work in this field has been limited to demonstrating this work to others. This project provides a modern web-framework to showcase this technology, including a feature for users to generate new Mozart scores.

Autonomous Target Elimination Drone Swarm

Using AI target detection combined with pathfinding algorithms, this project for Lockheed Martin creates a fleet of four to five virtual robotic drones and disables a wandering robot inside of a simulated urban environment. A swarm of drones can communicate critical information between one another to optimize the search speed of the mission. All of this is done through a virtual environment using ROS and Gazebo. The image recognition algorithm is trained on Google Colab using the YOLOv3 algorithm. Provides a safe, efficient, and sophisticated method for locating and eliminating predetermined targets.

Computer Science projects continued

KnugBot: Advising Chatbot for UCF Computer Science and IT Students

Designed for the UCF Dept. of Computer Science, *Knugget Advising Chatbot (KnugBot)* empowers advisors to allocate their time more efficiently by providing accurate answers to students' frequently asked questions. Reduces students' wait time for responses. Students can use it as their first stop for advising questions, and advisors can easily add, edit, or remove questions and responses as needed. Using state-of-the-art artificial intelligence techniques, the chatbot creates a custom advising experience for UCF, providing high value at no cost. Designed with extensibility in mind, the system has the potential to be used by other departments.

Senior Design Project Assignment Web Application

Currently CECS senior design students choose projects from sponsor presentations with a ranking process that the course professors oversee to assemble functional, customized teams. This project reduces the workload for senior design faculty with a web-based application for assigning students to projects based on the instructor's criteria and students' preferences. It automates the manual selection and assignment of projects, and allows for manual changes as circumstances arise. An admin interface allows instructors to set constraints, view conflicts, and verify that teams are well-balanced to ensure all students' success in the course. The student interface will allow students to upload their resumes, add relevant academic and professional experience, skill sets, and ultimately rank their project preferences.

SEE 2021: Simulation Exploration Experience - Autonomous Lunar Base Construction

This NASA project is among many university teams designing a simulated lunar mission for the April 28 SEE 2021 Conference. A launch site is required to move people and lunar products to orbit. This team designed and implemented a simulation that includes a swarm of robots working together to build a launch and landing pad on the surface of the Moon. This team set up the infrastructure and provided distributed simulation capabilities. Ultimately it will aid NASA's mission of establishing a long-term base at the Lunar South Pole by 2045.

“QubitVR” Quantum Computing in VR (Black Team)

A tool for learning quantum computing principles in an interactive virtual reality environment. Provides modules that help users learn quantum computing principles incrementally how to interact with the virtual environment. Useful for students seeking an entry-point into quantum circuits, and field experts finding alternative visualizations on their theories. Many available tools do well at simulating and visualizing quantum circuits but lack the educational aspects that QubitVR provides. This tool also explores the effectiveness of learning in virtual reality.

“QubitVR” Quantum Computing in VR (Gold Team)

A virtual reality-based learning tool to simulate and visualize quantum computing principles. Existing tools lack educational tutorial or practice. This VR application provides a three-dimensional space where students can directly interact with quantum bits, or qubits, and work with visual representations of how quantum phenomena affect these qubits, and it incorporates the real-world problem of quantum noise. Each module addresses multiple concepts with a tutorial and assessment for each. Can be used by scholars, teachers, and researchers, and can create learning opportunities for diverse high school and college students to learn about quantum computing.

Tactile Telepresence

With modern social-distancing practices, when someone is hospitalized, they remain separated from their loved ones. This project offers a way to physically connect, via an application and a device that simulates touch by visually finding devices on the patient's body and relating that data to a visitor to be interacted with to send touch data. This device may revolutionize the experience of families who have been separated due to hospitalization. No similar product exists.

ParaSpeech: A Speech Therapy App

A mobile speech therapy app to improve communication in patients suffering from aphasia, a condition that often results from stroke, brain tumor or head trauma. It provides a virtual space for recovering aphasia patients and speech pathologists to work together on personalized lessons. The patient is given a series of words and records themselves saying the word. Patients are graded by a lip recognition algorithm that assesses whether they articulated the word correctly. Aphasia patients can also see the correct way to articulate a word from speech pathologists' videos. This app provides instant feedback.

Elle-oh-Elle Multiplayer BetterRacer 2

An exciting and collaborative online way of learning languages, this new edition improves upon the current version of BetterRacer with a new multiplayer aspect. BetterRacer 2 is designed for young people and schools. The game takes the form of traditional racing games with various tracks, game modes, and power-ups. Can be used in classrooms and online to enhance language learning classes.

TeamSMS: Short Message Service and Case Management Capabilities for Microsoft Teams

Adds a Short Message Service (SMS) to augment the Microsoft Teams application and bridge communication with clients who do not have ready access to computers, but do have inexpensive access to texting. Designed specifically for nonprofit legal organizations requested by the sponsor TechThinkTank, a UCF-born startup. This team integrated case management capabilities into the application through LegalServer.

myGrowth: Your General Wellness Tracker

Combines the benefits of numerous mobile health applications into one iOS and Android application where users can cover every aspect of their health: fitness, diet, and more. Users are in full control of all the information they enter, meaning they can enter in as little or as much as they want since it is only being used for their benefit to visualize their health data. Designed to feel light and natural – much like a conversation – rather than a chore. Designed to increase the retention and motivation of mobile health app users. Can be personalized through points earned by using various features within the application.

CritEngine Online Service to Assist Role-Playing Gamers

A contact-free, socially distant online service to bring together a community to play their favorite tabletop role playing games. Existing services such as Roll20 and DnDBeyond are time consuming to set up; and supporting materials are expensive. CritEngine is a free online service that minimizes the time needed to set up campaigns so that players can dive straight into the game. Users will not have to spend hours tediously crafting every new item, character, and world from scratch. Additionally, the environment encourages community-building with people who share similar gaming interests.

Computer Science projects continued

“VR Sandbox” Virtual Reality-Building Simulation Game

An easy-to-use, entertaining 3D building application in an immersive virtual reality environment. Users can create, resize, reposition, recolor, and connect objects to make their imagination into reality in this sandbox environment. Provides a fun, creative outlet for people to build what they imagine and visualize it in a lifelike world. The game can also be used for design purposes to reduce cost, time, and limitations associated with creating a physical model. This project is simple to use and easy to learn while still providing users the full flexibility to create.

MathQuack: A Gamified K-12 Mathematics Review Tool

Designed to help K-12 students strengthen math knowledge and fluency in a fun way. Students use personal devices to solve math problems that create themed resources inside the game world in order to complete a whole-class goal. Unlike similar tools such as Kahoot, this uses procedural standards-based question generation with free-response answering (vs manually-entered multiple-choice questions), which allows for infinite replay, automatic differentiation, less teacher prep work. MathQuack focuses on time pressure and students’ contributions toward a whole-class goal rather than student-vs-student competition.

AAKCS - Advancing the Awareness of Key Cancer Susceptibilities

A user-friendly interface for doctors and patients to input genetic information and receive a report about identified cancer biomarkers. The algorithm parses the data and identifies the driver gene mutations for certain cancers. Another database contains resources and statistics for each diseases. Based on identified mutations, the backend will push relevant information to the interface for the user to see such as links to support groups, specialized hospitals, early detection information, and stats ie survival rate, # of cases.

Food Truck Geo-Scheduling Web and Mobile Application for Streets, L.L.C.

A food truck finder for customers, and a scheduler for food truck operators who can use the app to schedule themselves on a map. Unlike restaurants, food trucks must constantly update their customers on their whereabouts. While other “food truck finder” apps exist, this platform assists both parties, and it facilitates venue participation to schedule food truck events quickly and easily. Consumers can locate and bookmark their favorite truck and access menus for specific events. Helps food trucks get needed visibility for their business, an improvement over inconsistent social media marketing strategies.

Classroom Response System for UCF

A platform created for UCF’s Office of Distributed Learning that allows instructors to pose a question or create polls in class and students answer the questions on their personal device. The professors then can view the responses in real-time. Existing classroom response systems can be difficult to use, and either charge the institution or the student to use the tool. Existing systems tend to have confusing interfaces and require outside accounts to use. Existing solutions are not as intuitive because they are created to be the most generic solution possible so that the largest number of people will buy the product. This system for UCF is not be driven by profit.

Finch -- Personal Finance Projection App

A personal finance app that allows users to visualize and learn about their finances, improve financial habits, and plan for the future. All of the user’s finances and accounts can be viewed in one place. Users can input recurring income and expenses to track net worth over time, and set financial growth goals. Finch can simulate how an event can affect personal wealth or savings, based on historical data and more. A novel feature is the user’s ability to see in real-time their financial standing compared with others in similar financial scenarios (similar salary/housing costs etc). Finch uses powerful data-driven clustering to recommend financial products to the user, such as high-interest savings accounts.

Computer Science projects continued

“NICE Scanner” A Distributed, Open-Source Security Scanner

Analyzes corporate networks – which often have thousands of servers, workstations, IoT devices, phones, and other networked systems – from multiple perspectives. Scanning these systems is difficult as networks are often separated into different “zones” by firewalls, geography (offices, sites, retail locations), etc. This distributed scanner features a scanning “agent” at each security zone, which allows scans from different privilege perspectives such as from outside the network looking in, or from the perspective of an attacker on the network. An open-source policy repository allows for customization for small- to medium-sized businesses.

Knights Pantry Remote Inventory System

This new inventory system, web application and mobile application can change the way students and staff are able to interact with UCF food pantries. Students can reserve food and schedule a pickup time. Pantry staff can quickly and easily manage inventory and view statistics about daily operations. Others can learn about the pantry, its services, and how to donate. None of the UCF branch campuses at this moment have an inventory management and reservation solution. This system will provide that at almost no cost.

CampusQwest: Treasure Hunt App to Encourage Campus Exploration at UCF

An engaging scavenger/treasure hunt game on UCF’s main campus using students’ mobile devices. The application will use augmented reality and location services to create engaging features. Designed to give students and visitors the ability to discover many distinct locations on campus. The application can help establish a friendly competitive environment in which students participate and compete against each other, in exchange for unique rewards such as possible retail/restaurant coupons and in-game customization options.

Bitewise: Discover and Review Individual Menu Items

An application that allows users to rate and discover menu items at restaurants near them. Improves the restaurant dining experience by giving users the ability to rate individual menu items rather than restaurants as a whole. Instead of asking the waiter or waitress what to order, this app provides the opinions of many who have already tried a particular menu item.

Clef Musical Assistant Mobile App

This app for Android and iOS leverages artificial intelligence to inspire musicians. The Melody Assistant feature allows the user to input a short melody, and then uses generative models to create complementary melody completions. A Chord Progression Generator uses a custom algorithm to create chord progressions based on a key given by the user who can then use an AI model to generate a short improv melody conditioned on the chord progression. All creations can be saved as MIDI files in the app’s cloud storage and exported for use in other applications.

Persistent Cyber Training Environment Runtime Engine

The automated testing solution “Katalon” comes with a graphical user interface and a variety of libraries, and recently changed from free to a paid license. Gold Team and Black Team worked to build a testing environment that can execute testing scripts made in Katalon, with a straightforward and simple approach to reduce security vulnerabilities. Black Team built the engine that executes the test scripts; Gold Team built the libraries that the engine needs to function. The two parts were brought together so their sponsor can run test suites as they did before, no external servers needed. Simple design provides flexibility to modify the software in the future.

Electrical and Computer Engineering

All-Terrain Find: Computer Vision to Aid in Search and Rescue

Identifies the location of target, maps search area and surveils for obstacles using machine-learning vision techniques. After user provides pictures of the target, the robot searches the unknown search area, identifying obstacles and recording travel path and the location of obstacles, until it finds the target using a camera. When found, the robot marks the location, then uses the map that it created of the search area to find the shortest path back to its original starting point to give the user the location of the target. This hasn't been created before, and could increase the success and safety of search and rescue operations.

Automated Robotic Gardener

Reduces gardening time, water waste, pesticide use, and weed proliferation. Auto-Gardener does regular maintenance by navigating around the garden area and performs automated gardening tasks using microcontrollers: watering, detecting weeds, and monitoring plant vitals. It uses a drip irrigation system and weather information to optimize the watering schedule. It periodically sends activity information and photos to an online server to process for weed detection. It also provides an interface for users to monitor their garden remotely.

UCF Go Baby Go! Motorized Car (Computer Engineering Team)

Go Baby Go! is a national, community-based research, design and outreach program that provides accessible, inexpensive solutions for kids with limited mobility. Go Baby Go! has motorized cars that children are able to drive, but with limiting features. This team designed a prototype of an autonomous car system that can be integrated into future cars. With this prototype, children can drive the car easily, with little assistance. Parents can control the car with a new application to ensure safety. In addition, an inexpensive application can be added to help children communicate with others.

AutonoMouse: Robotic Rodent for Pets

A device that scurries around the house like a mouse. The goal is to entice a cat into attacking it. AutonoMouse is self-reliant, with its own charging plate so it can continue entertain a cat for hours with no human interaction. However, pet owners can play with their pet remotely via a Web app.

“Light Saver” Pedestrian Safety Smart Sign

To improve pedestrian safety at high traffic intersections, the smart sign identifies and detects pedestrians crossing the road, and alerts vehicles to their presence. It works with cameras and sensors that use real-time data from crosswalks, and warns vehicles using audible and visual alerts. Combines live data from multiple sources to provide better functionality. Solar-powered and environmentally friendly.

Signal-Operated Lock and Security (SOLAS) System

Simplifies house door unlocking. Using RFID communication, it allows the “key” to the user’s door to unlock the door automatically. An optional hand gesture-based password allows for increased security over pin-based keypads on current electronic door lock systems. An outside camera monitors usage of the system which the user can review on a website. Unlocking a house door is easier and more secure.

CtrlFlow, An IoT Modular Thermo-System

A smart thermostat that solves unbalanced heating/cooling distribution in homes due to the ineffective nature of common HVAC units. Provides a streamlined, convenient process, allowing users to adjust different temperatures in different rooms. This proof-of-concept small-scale model works by connecting vents with a valve mechanism that’s controlled by a series of microcontrollers connected to a central hub. The central hub sends signals regarding the behavior of the rest of the system, communicating with the system wirelessly. It’s connected to the internet via Wi-Fi to allow remote control via mobile app.

MagicMeds Automatic Pill Dispenser

This project makes remembering to take medication at the correct times it easy and simple. MagicMeds can be used for any supplement or medication that requires a schedule to be taken. Above all, MagicMeds is an accountability helper, providing a low-cost modern-day solution to integrate taking pills into an everyday routine with ease. Other solutions can be extremely pricey with monthly fees, or are outdated.

Power Systems Knowledge Hub for Florida Power and Light

With more renewable energy sources being added to the power grid, monitoring and maintenance of the complex grid system requires engineers with specialized skills. To attract more engineers to this field, more interactive learning methods are necessary. This project emphasizes the importance of increasing situational awareness in the distribution grid, and is intended to garner interest in power system engineering education. An interactive touch table allows users to learn about the power grid by interacting with a solar panel and with a real-time simulated distribution system. Users can see how the angle change of a solar panel affects its power output which can lead to variability and disturbances in the grid.

Smart Power Strip

Wi-Fi enabled power strip that allows users to have more control over the amount of power they consume. With an app, users can remotely control each of the four power outlets in the power strip to turn on or off. It records the amount of power being drawn so the user can lower and prevent unnecessary power usage. The outlets are controlled by an internal microcontroller that switches a solid-state relay on and off from a voltage generated by the microcontroller. Current products cost more with fewer features.

BikeSystem to Improve Bicycle Riding Experience

Designed to add to an existing bike, the portable and convenient BikeSystem will fit most popular bicycle designs. Users save time by swiping an RFID card across an RFID reader to have the locking mechanism lock or unlock in seconds. System includes a manual locking/unlocking option in case of no power. Metrics such as ambient temperature, distance traveled, and speed for the current trip will be displayed continuously on the LCD display once the bicycle is unlocked and in motion.

Interactive Self-Standing Training Bag for Martial Artists

Allows martial artists to exercise, train, and track progress without a training partner. The device offers several modes: Combination Generator, Cardio Mode, Reaction Mode and Accuracy Mode, and each has difficulty settings: easy, medium, or hard. Once mode and difficulty setting is set, user must position themselves before the corresponding side of the device; side A offers the Combination Generator mode, and side B implements all others. A performance summary is provided. In “ambient mode,” the bag becomes a decorative light fixture when not in use. Costs \$800 to manufacture, which leaves a profit margin while remaining a lower-cost option for buyers.

Automated Rotating Solar Plant Rack with Self-Care Capabilities

This project monitors and maintains the wellbeing of plants with sensors that provide real-time data of the plant’s health; an irrigation system provides water based on the moisture sensor’s input; and a shading system to protect the plant from over exposure to the Sun and take its input from the light and temperature sensors. A rotational system assures that the plant receives an equal amount of sunlight on all sides. Has IoT capability and can be controlled with a web app. An all-in-one solution to plant care needs, and can accommodate normal sized house plants. Powered by battery and solar.

Reducing Coronavirus: Robotic Facemask Dispenser Using Facial Recognition Technology

Uses machine learning and facial recognition to distribute single-use facemasks to unmasked people. Designed as a simple square box with an automatic door in the front. Once the robot detects an object within range, the AI sequence will kick in to determine if the object is a person. If so, it will check if that person is wearing a mask. If that person is not wearing a mask, the automatic door will open and allow the user to fetch a mask. The mask-wearing status will then be logged into a local database that could be used by scientists to study trends and correlations. In case a person is shorter than the height of our proximity sensor, the AI process can be started manually with a button.

Powering Roller Coaster Sensors Via Piezoelectric Transducers

This project provides an energy-harvesting solution that absorbs the energy from a roller coaster's vibrations and uses it to power a sensory device. While the scope is focused on roller coasters, this energy-harvesting sensory device has applications in road vehicles, military vehicles, and aviation. Many kinds of sensors do not require power to provide signals. However, this project aims to use those signals (from piezoelectric transducers) to power other kinds of sensors. The data will then be stored and transmitted using the same power harvested by the transducers, further conserving energy.

Traffic Stop Watchdog: Vehicle-Mounted AI System

At police traffic stops, body-mounted cameras and dashcams often leave much of the scene out of view or out of focus while lacking support for live-data communication. This vehicle-mounted system uses AI to track a moving target on camera while providing support for a wireless speech recognition device that the officer can carry. The vehicle-mount is lightweight and compact with a strong enough chassis to withstand vibration and acceleration. Camera electronics are powered from a standard car battery. A low-power speech-recognition device embedded in a small form factor design avoids weighing down the user. Wireless communication between the devices are intended to maintain a minimum range of 500+ feet. Machine vision algorithms allow onboard camera to track the officer so as to record only the information vital to the scenario. 180 degrees of rotation and high placement allows tracking in all forward directions.

IntelliDate: Wall-Mounted, Updatable Calendar

A wall-mounted monitor display panel that looks similar to a whiteboard calendar. Users interact with the display via a web application where they can add, edit and delete events from their calendar and modify the brightness level of the display. This device is a more affordable option than a current market product (DAKBoard) which costs \$399.95 for the display plus \$5 monthly to use the service. IntelliDate costs under \$300 to produce and offer the application as an included service. Standard whiteboard can be tedious to update and difficult to fit all events for a single day block. IntelliDate solves these issues.

Smart Greenhouse

Offers an affordable consumer version of complex greenhouses used by the commercial agriculture industry. Sensors monitor important parameters like temperature and humidity, then built in control mechanisms maintain optimal conditions for specific plant needs. Leveraging artificial intelligence, the system will be able to identify a plant from an image and monitor the health and track the growth of plants in the greenhouse. A companion smartphone app will display current ambient conditions, any important alerts, and a live stream of the plants in the greenhouse. Users can also use the app to modify target parameters and view stored data to track trends.

Mr. Farmer: An IoT Aeroponics System to Increase Agricultural Efficiency

Aeroponic systems reduce the amount of water used to grow plants. This project works with sensors to monitor the environment. A control unit processes data and determines healthy environment for plant growth and nourishment. Irrigation is controlled by logic implemented into the control unit that operates solenoids and relays for system controls. Possible applications range from other forms of irrigation control and industrial-scale vertical farming techniques to expand the amount of plant growth efficiently.

Corona Cooler: A Smart Beverage Cooler

Provides an all-in-one smart device that can chill contents and offer entertainment. The cooler has several sensors that provides information such as temperatures and UV readings. A Bluetooth speaker device provides entertainment. Incorporates solar technology to power all its components. A user-friendly, low-cost alternative to modern smart coolers, with an eco-friendly renewable energy source.

Therapy and Game (TAG) Bot

An in-home mobility exercise robotic toy that provides engaging physical therapy to supplement, and possibly reduce, in-person physical therapy office visits. Operates within an adjustable play area that can virtually fit in any home. A camera will overlook this play area to detect the TAG Bot and works alongside a Raspberry Pi to detect incoming objects. The player's goal is to land a hit on the TAG Bot, while the TAG Bot's goal is to detect any incoming threat and to avoid it as much as possible while staying within the play area. Shaped like a turtle shell, it's designed for minor collisions with objects. Features on-board touch sensors to detect successful hits. The manufactured printed circuit board contains features like an Arduino CPU, Bluetooth 2.0, and battery-power support.

Sphere Stabilizer 3000: Educational Tool to Introduce Control Systems Concepts

Designed to be fun and intriguing to inspire STEM interest. The device achieves constant balance of a spherical object, not allowing it to fall off its platform. The Stewart platform design allows six servo motors to run beneath simultaneously, altering and supporting the platform in the air and maneuvers components efficiently and accurately. This platform is used in scientific testing, medical rehabilitation, and pilot training for its wide range of motion. For this project, when a ball or sphere is placed on the touch screen, the microcontroller notes the ball's position. If the ball moves away from the center, the microcontroller tracks its position through the touch screen, then responds by activating the servos which control platform movement. Designed to be mobile and simple to understand by diverse audiences. Its whole-system view means users can see which parts are moving and when, based on the ball's location.

Automated Solar Panel Cleaning System

Decreases the impact that dirt and debris have on solar energy collection. The system automatically cleans the solar panel that it is attached to on a regularly scheduled basis. It can be used on commercial solar panels or panels secured to homes for residential use. It works by dispensing water on the panel, through a drip hose attached to a wiper blade, and swiping down the panel to remove dirt, dust, and light debris. In addition to this, it also has a rain sensor component to detect the presence of rainfall. During the rainfall, the system will run without the use of the water pumps, in an effort to conserve water while cleaning.

Augmented Driving Development Kit

Testing augmented driving technologies can involve using full sized vehicles which can be expensive, dangerous, and difficult to interface with. This project provides a user-friendly module that can replace the traditional control unit in most RC cars. It provides users with complete control over the RC car's normal functions, and allows them to add sensors and their own custom programming to extend the functionality of the car. Made with a power computer to run complex programs, a suite of sensors to get positional/driving data from the car, and standard connectors for adding other sensors, a camera for live video feeds, and a custom software library to allow users to interface with almost any RC car. Simple for novice RC car users, yet robust for AI researchers. Collision avoidance, sign recognition using AI, and other driving maneuvers can all be performed and controlled from a desktop application.

AMP'D: Automatic Medical Pill Dispenser

A medical device with an intuitive mobile health app. Has multi-pill sorting capabilities, and dispenses up to three different types of pills of various sizes. The software function will have the ability to add a scheduler system for the user to set up and time and date of dispensing. Device is controlled via a software application that will activate multiple servo motors to dispense the pill into a cup with additional sensors to aid in the accuracy and effectiveness of the dispense. The accurate and precise user interface is simple to use. Also, prescribing doctors could use it to set up a dispensing schedule and monitor/analyze patient's daily drug use activity.

SAEMS: Smart Alert Environment Management System

An environmental management device that detects smoke, carbon monoxide, carbon dioxide, particulates, volatile organic compounds, motion, temperature, humidity, and pressure. This device will actively sense these conditions with onboard integrated sensors. Designed to provide an integrated solution for home environmental management, with ability to be incorporated into an existing smart-home ecosystem by taking advantage of mesh networking such as SmartThings, Google Nest, and Amazon Alexa.

UCF Go: A Parking Solution for All

A mobile app that helps find your vehicle in crowded parking lots. The vehicle's location is saved and shown on a map. This mobile app would connect to each individual parking spot through a QR (Quick Response) code. The process is: the user parks; a hardware sensor scans the QR code; then via Bluetooth, the sensor transfers the data to user's mobile phone; the car's location is displayed on the app. Previous similar projects had a function to track the availability of parking spots, but did not have a vehicle locator function. Users need only to install the Raspberry Pi system to be able to make use of the vehicle's location storing function.

Industrial Engineering and Management Systems

Coca-Cola: CIP Checklist – Time Tracking System

This team worked to create a digitized system built in Microsoft Power Apps that will allow supervisors to assign cleaning and sanitation tasks using a computer or mobile device, replacing client's paper-based system and eliminating unnecessary file cabinets and other furniture taking up facility space. The plant has nine lines that follow the same cleaning protocol (five different machine centers). The cleaning-in-place (CIP) process is allocated 6 hours and the allergen CIP takes 12 hours. The plant is open 24/7 using a special shift change system. The team identified tasks to separate elements of the CIP and perform time studies and set standards for each task. The data collected was used by computer scientists to design the new database, which documents start and finish of each task, and tracks and notifies if the last cleanup was done after a set amount of time. The system also notifies supervisors when time elapsed after last cleanup are accrued. Client will be able to reduce waste, track productivity effectively, automate and/or remotely assign tasks, automate record keeping, and have access to real-time data.

Connected Worker: Research Laboratory Improved Workflow

In most research laboratories, testing procedures are locked to the display near the instrument being used. This takes the scientist's attention away from the testing material or instrument and can lead to errors. This project provides 'As I see it' views of a lab process, using extended reality technology to create a demo Connected Scientist via assisted reality workflow within a quality-testing environment. The solution employs wearable display technology that provides a heads-up, interactive workflow that an analyst can follow while staying focused on their testing procedure.

Systems Engineering Toolkit for U.S. Army Program Executive Officer for Simulation, Training and Instrumentation (PEO STRI)

The U.S. Army PEO STRI does not have an environment for managing information used to train, guide, and assess systems engineering tasks. A capability is needed to maximize training and tool resources available to the workforce. This team has performed market research to find the best option to support PEO STRI's current needs and provide a solution. Computer science students will continue this project.

Splicing Machine Improvement; Splicing Process Optimization for Total Refrigeration Gaskets

This team has applied project management techniques, simulation, data analysis, economic engineering, ergonomics, thermodynamics, robotics, and electrical engineering concepts to improve TRG's gasket splicing machine and its table, and to optimize the gasket splicing process. The team's deliverables include a simulation of the current machine and its performance; a cost-benefit analysis that measures the cost of building and implementing the prototype vs not building the prototype; and an ergonomic analysis report that will evaluate and describe the risk and controls associated with machine and human interaction of current machine and how the new machine accounts for it; and the design concept of the new machine that a future team will use to create a working prototype.

Inventory Management Improvement for Advanced Vascular Solutions

This team was tasked with improving inventory management for a medical clinic that specializes in arterial, venous, and wound care. AVS does not have an automated system to track inventory or to indicate when stock needs to be replenished. Using Six Sigma tools and various analyses, the team has helped AVS reduce excess cost while optimizing inventory usage and storage. Clinic staff can better plan for inventory shipments. As a result, AVS will be able to save money and storage space while also ensuring reliable, high-quality patient care.

Engineering Drawing Release Tracking and Measuring Software for Aerion Corporation

A low-cost tool to track and monitor the release of engineering drawings for aircraft parts related to the development of a new supersonic business jet. Aerion must keep an aggressive production schedule. This project helps ensure that jet parts are made and delivered in time so production will not be delayed. The team analyzed production need dates and lead times for every step of the production process to calculate exactly when drawings are needed. Data provided by client was analyzed and manipulated to show different trends and metrics that will help departments manage the production process.

Facility Layout Optimization for Aerion Supersonic

In anticipation of Aerion's plan to start producing supersonic jets, this team was tasked with helping to assess goods-movement paths and logistics within the main building of client's one-million square foot facility equipped with state-of-the-art automation. This included checking if paths between stations have enough clearance and modeling their production schedule to find areas of improvement. This project helps Aerion staff know what to expect from their facility layout and what design improvements can be made. A fully optimized facility can help achieve the goal of producing 48 supersonic jets per year.

Implementing AI in Law Firm Processes

The client is a Colombian law firm seeking to increase lawyers' efficiency with artificial intelligence. The team created an automated system to allow the creation of a list of documents after the client fills out a form, enabling lawyers to advance faster through the case by standardizing their process which leads to increased efficiency in their work process and servicing clients. The use of AI machine learning creates a system of constant improvement; therefore saving time and money at an increasing rate.

Emergent-Dependent Spacing in Airport Terminal Airspace: Adjacent Arriving Aircraft

Airspace near terminals is limited. The FAA needs to properly assess the risk that occurs between arriving aircraft in order to prevent collisions and give greater assurance to stakeholders. This team worked to provide the FAA with critical background information on the hazards and risks associated with arriving aircrafts, analyzing the FAA's collision risk model. They used a systematic literature review approach and analysis of statistical methods to evaluate the logic behind the FAA's current risk assessment model. The evidence presented by the team will guide the FAA's Flight Research & Analysis Group on whether to continue relying on the assumptions their current model is built on or if a more reliable model is needed.

stemCONNECT Classroom Presentation Process Improvement Project

The client, stemCONNECT, provides a network of STEM experts who give presentations, by request, in school classrooms to inspire student interest in STEM fields. The client has no system to manage processes, procedures, and responsibilities for achieving these objectives; therefore has no way to measure success or growth, or support expansion goals. This team created a system to optimize different processes – such as the way speaker requests are received and fulfilled – using Six Sigma tools. The system refines current operations and serves as a template to be used later for administrative automation, such as automatically-generated feedback surveys. The team's solution aims to reduce administrative tasks by 20 percent and increase presentation sessions by 60 percent.

Warehouse Layout and Process Development for Load King

Load King is a turnkey manufacturing company in Jacksonville providing a range of manufacturing and engineering services. The company seeks to expand into new markets such as hospitality, ecommerce, and modular construction. This team developed and recommended a robust, modular layout for a new warehouse and accompanying processes. This layout and system will have to be agile and flexible enough to accommodate various new sector needs and shifting priorities. This solution allows Load King to have a strong expansion into these new sectors and increase operations efficiency and profit.

Advanced Wood Fabrication Cell Layout & Process Development for Load King

Load King is a manufacturing company in Jacksonville, FL, that delivers “ready for immediate use” products. They wish to extend their current wood fabrication capabilities – one of the most critical manufacturing lines of their business – to keep up with the growing demand. This team worked to integrate the layout, machinery, processes, and software required for a vigorous, efficient, sustainable and flexible manufacturing process. The team identified all requirements of the wood fabrication cell based on current and future demands, optimized the layout and machine use, and integrated automated systems to minimize labor. Load King will be able to expand their business to newer markets and have confidence that their system can handle larger companies with higher-volume work orders.

Evaluating the Digital Transformation of a Lockheed Martin Production Facility

COVID and other situations have led to increased demand for Industrial Manufacturing to digitize existing production processes. But the ways to effectively measure performance have not kept up. Companies undergoing digital transformation do not have a clear understanding of how digitization is benefiting them. This lack of clarity has consistently contributed to delays in implementation. Our goal is to bridge this gap using a simulation framework capable of accounting for the differences between a digitally transformed production facility and a non-digitally transformed one.

Improving Operational Efficiency & Increasing Profitability for Night-Lite Pediatric Urgent Care

This client hopes to increase patient flow efficiency, customer satisfaction, and overall profitability. This team proposed implementing a process of increased communication between the urgent care facility and its patients upon their arrival and after the registration process. A notification system will inform patients of their position in line while in the virtual waiting room. Physical signs at the facility and informational directories on NLP’s website will further clarify to patients all COVID-19 procedures they are expected to follow; and how to gain the most out of their reception experience. The team analyzed the current system using process maps, and other collected data to reach final recommendations. The proposed new methods, in addition to NLP’s improved virtual registration platform, will decrease bottlenecks in the process that form during rush periods. Suggested methods are low-cost solutions compared to other potential solutions, such as hiring more staff members. Increasing this communication with patients will also increase customer satisfaction.

Customer Prospecting for Pelliconi, an Orlando-Based Bottle Cap Manufacturer

Pelliconi makes bottle caps for companies such as Dr. Pepper, Refresco, Snapple, and Yuengling, and seeks to expand into other markets. This team set out to identify potential manufacturing customers or opportunities, and has provided options for exploring new markets outside the beverage industry with a goal to connect Pelliconi to at least three new potential prospects. This team analyzed the client’s competitive advantages that make exploring potential customers easier, including their unique relationship with one of the largest machine manufacturers in the world.

Identifying Opportunities for Improvement in Clinical Research Trials at Sensible Healthcare

The client's primary focus is on FDA-approved phase 2,3, and 4 clinical trials which require managing complex workload and scheduling tasks associated with the multiple tests and procedures of clinical trials. The amount of work associated with these tasks is especially noticeable in non-alcoholic fatty liver studies made popular in recent years. A surprising number of appointment cancellations, combined with high "Screen Fail" rates of patients that do not meet clinical trial criteria, result in time lost to non-patients, with few patients successfully converted into the lucrative long-term randomization clinical studies. This team examined the operation of the clinic and its screening processes to determine if the Screen Fail rate and its associated time-consuming lab work can be more efficiently managed.

Sofa Shipping and Packaging Cost Optimization for Steelcase

Once a Steelcase sofa order is placed, the manufacturing process occurs in one of four facilities around the world. Boat transportation is often used which requires shipping containers. Due to the diversity of weights and measures of the sofa product line, the vertical space in the shipping containers is not being used to its full potential. The trade-offs between packaging cost and the ability to upload freight is not well understood and has never been optimized. This team will work together to reduce the total cost of packaging, freight, and shipping by 20 percent per unit by redesigning the client's sofa packaging and loading methods. The findings from this project could be expanded to additional product lines and transportation methods.

Mechanical and Aerospace Engineering

RackSmart Integrated Racking Control System for ABB

This system sends a signal to perform and monitor the racking operations of a circuit breaker within a switchgear. Intended to improve operating safety conditions for technicians. Contrary to the outdated process of manual racking, this controller allows for a simple and safe plug-&-play approach to engage the racking process. Lightweight and has a cable that can reach a greater distance. Its ergonomic layout enhances user safety, reliability and comfort. This model is readily able to integrate components, such as a touch screen user interface or other advanced components, allowing ABB to build upon this design.

Shark Skin Vortex Generators and Tunable Structures

Inspired by other designs that mimic shapes found on Mako shark skin, this project aims to conduct simulations to evaluate the benefits of adding shark-skin vortex generators in conjunction with common vortex generators at their respective locations, on the wings of Cessna 170 and create a novel actuation system that will allow the vortex generators to deploy and retract mid-flight. This combination of systems could improve fuel efficiency, lift-to-drag ratio and overall performance.

Ecosphere: Small Satellite Research Platform for Life Sciences Research

A low-cost CubeSat for the Florida Space Grant Consortium that can transport an ecosystem of brine shrimp and algae into space to test their cultivation, and research their survivability. The design includes system elements to keep the ecosystem thermally balanced and a sensor package to characterize its survival and how it reacts with the in-space environment. By providing a low-cost platform for cultivating organisms in space, this project can help investigate possible renewable food sources for long-duration space travel.

MicroSat Development for Plant Research (Team Gaia-X)

On the International Space Station, NASA astronauts are growing cabbage, Swiss chard, radishes, and peas. Ultimately, the production of food and supplies remain essential beyond this orbit yet the topic has not been widely researched. Gaia-X is a modular 6U CubeSat that will aid in understanding plant growth for Lunar Orbit. The system contains an autonomous, protected plant growth chamber that can successfully grow kale. The system serves the larger goals of the industry to colonize the Moon and Mars by acquiring growth and radiation information from self-sustaining plants.

Integrated Sustainable Building Design for ASHRAE (Black Team)

A student competition that requires teams to design an energy efficient sustainable building with minimized energy demands for HVAC and all other technical systems that could be satisfied with locally available or building-installed renewable energy sources. The team was asked to satisfy a national or local sustainability standard, and then implement renewable energy sources to approach "Zero Energy" limit.

Integrated Sustainable Building Design for ASHRAE (Gold Team)

This team was tasked with selecting the best HVAC system for a building design. The team considered many factors including indoor air quality and temperature, the prevention of unwarranted infiltration, and cost of the system compared to the budget. The final building model is a complex system selection that is driven towards maximum energy efficiency. This unit has a variable capacity of 75-400 tons which will have more than enough capacity to meet the building's 100 ton cooling load. The chiller will be paired with a CTS cooling tower. The building's climate zone means a sizable increase in load for heating, which is handled with three 60-ton boilers.

Human Powered Vehicle Challenge for the American Society of Mechanical Engineers

Competition teams must design and manufacture a recumbent tricycle to compete against other human powered vehicles in speed, endurance, and innovation. With this environmentally sustainable and inexpensive mode of transportation, the driver uses pedaling force to propel the vehicle forward. A lightweight aluminum chassis surrounded by a fiberglass fairing reduces resistance on the vehicle and protects the driver. The design is comparable to racing tricycles, with the addition of an aerodynamic enclosure. These factors make it a more viable mode of transportation beyond recreational purposes.

Solar Step: Solar Desalination (Green Team)

With this stepped solar still, salt water is let in through the upper end, which flows into a set of basins in a stairstep arrangement. When the top basin fills with water, the water flows over into the basin below it until all basins are full. Sunlight shines in through a clear acrylic top, heating the basins and the water within. The water evaporates and condensation collects onto the acrylic and slides down the slope, then is collected into troughs which drain into a water jug. Materials with good thermal properties and reflectors that increase the solar energy that reaches the system increase productivity. Produces enough clean, drinkable water for a family. Easy to use, maintain, and transport.

Solar Desalination (Blue Team)

Portable system desalinates seawater and brackish water sources for human consumption. Made for areas with ample sunlight and access to seawater. Uses a double membrane system inside a spherical heating chamber. The chamber is heated with a parabolic reflector, causing evaporation off of the primary membrane. The secondary membrane, cooled by a heat sink, absorbs the vapor and drips the distilled water into a clean reservoir. Salt and other impurities are trapped into a filtering membrane.

Solar Desalination (Red Team)

Compact, easily transportable, and made of commonly found materials so it can be built and maintained wherever used. Designed for areas affected by natural disasters, relying on the power of the sun to reduce the need for large complex multistage systems. Cost effective and easy to manufacture. The system operates by carrying seawater up against a plate heated by the sun in a membrane to be evaporated across a waterproof fabric and condensed into another membrane to be carried out of the system.

Photoreplicator: Increased 3D Print Resolution in Less Time Using UV Curable Resin

In 3D-printing manufacturing, the resolution of parts increases proportionally to the fabrication time. This team set out to significantly reduce manufacturing time while retaining the same quality as the layer-by-layer printers. A UV curable resin and a photon-emitting source is applied to print the desired part with a high accuracy. The resin cures as it absorbs the photon energy starting from the inside out, enabling the part to have a detailed depth or empty volumes if needed. The 3D shape is achieved by rotating the resin vat about the z-axis so that the 2D shape is able to achieve its desired outcome. Minimal post-processing is required to complete the curing process. This near-instantaneous printing could revolutionize the world of additive manufacturing with many applications.

Irrigation Innovation for Guard Dog Valves

Minimizes the effort involved in fertilizing lawns. The project properly mixes a small amount of concentrated fertilizer with water through an in-line injection system attached to the user's sprinkler. By lightly fertilizing the lawn each time it is watered, the fertilizer's negative impact on the environment is nearly eliminated and the amount of fertilizer required to maintain proper lawn care is significantly decreased. Provides a low-cost alternative to current fertilized watering methods.

Hybrid Propulsion Rocket (Black Team)

This team designed, built and launched a hybrid propulsion rocket that can reach at least 2,000 feet in altitude. The rocket uses a solid fuel grain and a liquid oxidizer to provide thrust. When it reaches over 2,000 feet, a dual parachute recovery system deploys to safely descend the rocket under 15 feet per second. Force and altitude sensors read pressure and altitude at different points of the flight. This data will be crucial to understanding how the rocket functioned. Hybrid rocketry, specifically hybrid motors, are still in development in the aerospace industry, and not widely used. This project could aid future research.

Hybrid Propulsion Rocket (Gold Team)

This team designed, built, and launched a hybrid propulsion rocket that follows a set of altitude and design requirements and criteria. A hybrid rocket uses a combination of a liquid oxidizer and a solid fuel grain to induce combustion. This combustion creates a gaseous byproduct that is forcefully expelled from the aft end of the rocket's nozzle, which creates the thrust that enables rocket flight. The resulting cost-effective design could be used by hobby rocket enthusiasts, university rocketry teams, or future senior design teams. This team considered factors to reach certain altitudes, including aerodynamics, and various parameters such as center of mass and center of drag.

Multi-Stage High-Powered Solid Rocket (Black Team)

A multi-stage, high-powered, solid propulsion rocket with two motors that propel the rocket to reach a minimum height of 2,000 feet while carrying a fragile, egg-like payload. A custom-designed separating mechanism allowing the rocket to be built in two sections. Each section contains a H550 rocket motor with an impulse of 313 N*s per motor. Custom programmed flight electronics inside enables the rocket to separate in flight once the first stage motor burns out and the second stage motor ignites propelling the rocket higher. The flight electronics are programmed to deploy a recovery system during various points in flight. This rocket has multiple custom designed components, either 3D printed or machined, making it unique to the limited multi-stage model rockets commercially available.

Multi-Stage High-Powered Solid Rocket (Gold Team)

This team created a multi-stage high-powered solid rocket that reaches a minimum altitude of 2,000 feet while also transporting a payload. During flight, the rocket detaches from a motor booster and remains stable with use of self-stabilizing fins. The payload is housed in a container within the rocket and must not crack under the conditions of launch, ejection, and recovery. The methods used in this project have the potential to be used by large or small aerospace companies to develop and improve rocket technology.

Redesigned Cervical Collar for Long-Term Ligament Instability

This team set out to improve a hard cervical collar design for an individual with long-term spinal instability. Includes modular components allowing user to customize the appropriate balance of restriction and comfort for various applications. This design features detachable shoulder pads which distribute forces away from the body's center line, and additionally offers biofeedback on head positioning to ensure there is no further spinal damage. While this collar is tailor-made for a particular individual, various features of the design can easily be modified to fit people of different measurements.

Underwater Remotely Operated Vehicle (Blue Team)

Capable of submerging and traversing underwater, and providing live video-feed and data about its position and orientation. It can retrieve objects up to 5 lbs. and resurface within a time constraint. The project involves fluid mechanics, computational fluid dynamics, computer-aided design, electronics, and controls. This design makes use of its almost neutral buoyancy to submerge via propulsion and traverse underwater with another set of thrusters. A dynamic ballast system aids the vehicle to resurface after securing an object. Possible uses include sea-exploration or underwater repairs.

Underwater Remotely Operated Vehicle (Green Team)

This ROV can be controlled from a distance for the purpose of low-cost surveying of regions and retrieval of small objects underwater. It operates fully submerged in water, and captures video, retrieves objects, and provides live positional data. It works using a combination of electrical power with mechanical subsystems that help move it around underwater. Manually controlled via a laptop and tether system. Object retrieval is done via a hook and motor system. This is a low-cost solution compared to commercial ROVs, and can be easily modified and/or customized.

Underwater Remotely Operated Vehicle (Red Team)

A fully submersible ROV that can perform various underwater tasks, including submerging up to five meters; retrieving objects weighing up to 5 pounds; successfully navigating a predetermined obstacle course within a 90-minute timeframe. The ROV maintains real-time communications to the operator through a variety of components such as a micro-controller, ethernet cable, and real-time video and signal processing. The project involves the application of fluid mechanics, electrical engineering, computer aided design and computer science.

Underwater Remotely Operated Vehicle (Black Team)

Traverses an underwater course and retrieves and delivers three objects of up to 5 pounds each with a hinged arm and hook. During the course, the ROV is controlled from a distance of up to 50 meters away by a user on land without direct line of sight. It operates along the water's surface and scan the water below for objects to retrieve. The design involves a combination of thrusters and a dynamic ballast system for lateral and vertical maneuverability. Ballast tanks and vertical thrusters increase the battery life. Various electrical components are housed in the dry tube. This ROV can be controlled with a mobile device, with tethered Wifi connection.

Underwater Remotely Operated Vehicle (Gold Team)

The team designed and built a low-cost remotely operated vehicle with the capability of submerging to a depth of up to 5 meters. With the ability to take photographs, store data and pick-up small objects, the vehicle can be used in underwater applications where it may be difficult and/or unsafe for humans to enter. The vehicle provides a cost-effective option to perform simple underwater tasks.

Adjustable Prosthetic Socket

Current prosthetics do not account for the fact that residual limbs experience volume changes throughout the day. Amputees must wear overly restrictive and tight, uncomfortable prosthetics, which may lead to skin and tissue damage. This project is an automatically adjusting prosthetic socket, designed to sense pressure changes in the socket and respond to it by automatically changing the socket size to accommodate the new volume. The socket size will change via an inflation or deflation of strategically placed air bladders that line its inside.

Stealth Surveillance Glider Unmanned Aerial Vehicle

This team designed an acoustically stealth UAV that turns off its propulsion system and glides over the area of interest. Features an optimized design for achieving highest possible glide ratio to survey the broadest area possible before returning to the user. Considerations include airfoil selection, the use of winglets, maximization of aspect ratio, and a low cross-sectional frontal area. Flight stabilization is achieved with a PixHawk flight controller. UAV provides a live-video feed and has user-friendly control mechanisms. A low-cost, versatile solution for military, farmers, even land surveyors.

Surveillance Unmanned Aerial Vehicle for AIAA Design Build Fly Competition

An unmanned, remote-controlled aircraft that carries heavy cargo and performs aerial surveillance. This project is competing in the American Institute of Aeronautics and Astronautics national competition. The aerodynamically stable design includes an extremely stable towed sensor subsystem to achieve mission requirements on a cost-friendly budget. It has a telescoping rigid rod that deploys at mid-flight and lowers the sensor at the required height to perform surveillance. When complete, the sensor and the rod are retracted back into the vehicle and stowed away safely before landing. Applications for this type of aircraft include flight over war zones or inhospitable terrains.

U.S. Dept. of Energy Solar Decathlon: Suburban Single-Family Home (Black Team)

A national competition challenging teams to design sustainable net-zero energy housing. Net-zero means the annual delivered energy is less than or equal to the on-site renewable energy generation. Team Black's design of an earthy-friendly suburban single family home was selected as one of 63 finalists competing April 15-19. This team's design involved comprehensive building science, optimized mechanical and electrical systems, and water conservation. Other considerations in the design include affordability, comfort, resilience, health, and safety.

U.S. Dept. of Energy Solar Decathlon: Mixed Use, Multi-Family (Gold Team)

A national competition challenging teams to design sustainable net-zero energy housing. Net-zero means the annual delivered energy is less than or equal to the on-site renewable energy generation. Team Gold's "The Beyond" design is for a mixed-use multifamily building. Energy efficient systems are used throughout. This modular community is a living solution for students in high-priced rental markets.

U.S. Dept. of Energy Solar Decathlon: Attached Housing Design (Blue Team)

A national competition challenging teams to design sustainable net-zero energy housing. Net-zero means the annual delivered energy is less than or equal to the on-site renewable energy generation. Team Blue submitted a design for the Attached Housing Category, proposing a design for student housing at UCF. The design contains a total of 80 dwelling units on 182,000 square feet. The remaining 205,000 square feet will be designated as green space for diverse uses for the community to enjoy.

Micro Unmanned Aerial Vehicle for SAE Aero Design Competition (Gold Team)

Small UAV competition for Lockheed Martin. Has a fixed-wing structure and carries a delivery box plus a 2-pound payload. It takes off in a short span of 8 feet with or without the payload. Considerations include maximized wingspan and proper airfoil to increase efficiency and lifting capabilities. A larger battery was selected to support a longer flight time with a heavier payload, and the motor-propeller pairing provides optimal thrust and power for a smooth controlled flight. Micro servos power the ailerons and elevator to provide turning and lift control. Landing gear was 3D printed using ABS plastic.

Micro Unmanned Aerial Vehicle for SAE Aero Design Competition (Blue Team)

Designed within competition guidelines to carry a box and payload plates around a course. This UAV features a modular design so parts can be changed easily. Can be used to transport small loads, surveillance, and other applications. Low-cost yet strong and lightweight construction made from polystyrene foam core boards.

Micro Unmanned Aerial Vehicle for SAE Aero Design Competition (Black Team)

The competition challenges students to design and build a fixed-wing, light aircraft that can support the largest amount of payload weight possible while also carrying delivery boxes externally. This team's aircraft is made from 3D printed material, foam, balsa wood, and carbon fiber which results in a cost-effective lightweight vehicle. Could be scaled up for use as a carrier-takeoff aircraft, possibly carrying high amounts of missile payload, designed for quick takeoff flight and high lift operation.

Micro Unmanned Aerial Vehicle for SAE Aero Design Competition (Green Team)

This team produced a small, lightweight, all electric UAV that can deliver boxes and static cargo. Additionally, the aircraft can take-off from a short and raised platform, sprint to the first turn of a flight course, and balance weight, thrust, and drag for the rest of the course—all within power, size, and landing limitations. Possible applications for this product include rapid delivery along short distances and inspiration for future aircrafts that take-off from short platforms.

Micro Unmanned Aerial Vehicle for SAE Aero Design Competition (Red Team)

One of six teams challenged to build a micro UAV within specific rules and regulations. Considerations include aircraft weight, electronics, and engine selection. Synthesizing project management tools, including Gantt Chart, a flow diagram of all tasks was incorporated to complete project deliverables. The team used three main materials, including 3D printing filament, carbon fiber, and Balsawood for manufacturing ease. This cost-effective product could be used for aerial deliveries, security system advancements, and manufacturing processes.

Micro Unmanned Aerial Vehicle for SAE Aero Design Competition (Silver Team)

This team designed a micro UAV to take-off in eight feet, all the while carrying a payload of metal plates and boxes. A brushless DC electric motor provides thrust for take-off and keeping the UAV airborne. The servos connected to the ailerons and flaps on the wing, and the elevator and rudder on the tail, allow control during flight. Research, testing and analysis went into design considerations to influence fuselage shape, the chosen airfoil, and the unloading mechanism.

Tunable Structure-Adjustable Testing Rig for Metamaterials

This rig can run multiple data acquisition processes while metamaterial is under load. Electromagnets attached at the end of the beam and to the actuator platform provide an impulsive force. Following the excitation, a slow-motion camera records the motion of the beam. Beam amplitude measurements are documented by placing a grid behind the excited end of the beam and recording the amplitudes of each oscillation until the beam comes to rest. Rig can be customized: metamaterials of many sizes can be tested by adjusting critical points on the rig. The actuator can be swapped out for actuators of different kinds (i.e., magnetic, impulse, etc.)

Go Baby Go! (Red Team)

An electric, ride-on car modified designed for a child with limited movement of the lower limbs and hindered trunk control. These factors impacted the overall design for the modifications made to the vehicle, that include collision prevention, limited parental control, zero-turn radius, body support, and an accessible and long-lasting battery. Features direct access to a joystick and an iPad or Dynavox to communicate with others.

Go Baby Go! (Green Team)

A modified ride-on vehicle tailored for an 18-month-old child with mobility challenges. This team collaboratively constructed all modifications with an adjustable component accommodating child's growth, assisted seating through a head and trunk support system, amplified communication through an electronic learning system, and ensuring foremost user safety through sensor detection and further simplified controls. This supportive, comfortable, and long-lasting assistive ride-on vehicle is intended to provide an entertaining experience while contributing to rehabilitative efforts.

Go Baby Go! (Black Team)

By modifying commercial ride-on toy cars, this project provides a low-cost solution to improve the mobility of children with disabilities while also improving their spatial awareness. Go Baby Go! focuses on enhanced safety and accessibility features that traditional electric ride-on cars lack, including steering and body-support enhancements. Previous GoBabyGo! iterations were small and usable for only a year due to child's growth. This team used easily producible components to design a vehicle for larger children to be used for at least two years.

Go Baby Go! (Gold Team)

This team was tasked to go beyond standard modifications for GoBabyGo! vehicles to accommodate a child with a rare genetic condition called Snijders Blok Campeau Syndrome which gives him low muscle tone and delayed development. The team outfitted the car with ultrasonic sensors that feed into an obstacle avoidance algorithm to gently assist the child away from potential collisions. Safety and comfort details include ergonomic seating and a secure, 5-point harness. The car has remote control operation for caregiver to intervene and take direct control of the vehicle. Provides a safe and comfortable environment for the child to play independently.

Distributed Electric Propulsion for Aircraft (Blue Team)

This electric aircraft carries a full 28 oz. bottle of liquid while maintaining stability despite sloshing dynamics from the cargo, and demonstrates the aerodynamic advantages of DEP technology over traditional aircraft propulsion. Achieving a maximum number of competition laps requires endurance as a design factor, so battery performance was a top priority. This aircraft has an exact 3D-printed design for the body, elliptical wings, and a relatively large cargo bay. DEP technology offers a greater aerodynamic advantage over a typical drone, allowing for longer, more efficient cargo flights.

Distributed Electric Propulsion for Aircraft (Red Team)

DEP offers numerous advantages with multiple propellers along the edge of the wing. Increased control, reduced noise at takeoff and landing, more efficient cruise speeds, higher overall flight range, and reduced landing distance are achieved due to increase in dynamic pressure across the surface of the wing, thus increasing lift and decentralizing it across the entire area. A typical propeller-driven aircraft maintains increased dynamic pressure in the region directly behind the motor. Due to current battery energy density, DEP is limited to smaller aircraft such as 1 to 3-seater passenger aircraft.

Distributed Electric Propulsion for Aircraft (Black Team)

An electric aircraft needs to generate enough lift to support the weight of its fuselage, cargo, and power source. Compared to fossil fuel, batteries are less energy-dense, so the added weight makes flight more difficult. As more weight is added, more lift is required to sustain flight. This project optimizes the energy efficiency of an electric aircraft by distributing six small motors along the wingspan. The motors turn propellers to create thrust, and accelerate air over the wing to create lift. Harnessing the work output of the motors to directly generate lift in addition to thrust lowers the power requirement of sustained flight.

Distributed Electric Propulsion for Aircraft (Gold Team)

DEP is a recently developed theory that allows a plane to be fully powered by electricity. This idea can be possible by using multiple electric motors lined up along the leading edge of the wing, resulting in a manipulation of the airflow passing over the wing. The velocity of the airflow is increased over the wing, resulting in an overall increase in lift; therefore, an increase in efficiency, endurance, and performance without the need for fuel. This project emulates a DEP system on an unmanned remote-control aircraft to demonstrate that it can help increase an aircraft's lift and decrease an aircraft's power consumption.

Autonomous Ground-Based Vehicle (Blue Team)

This project is one of six competing for the fastest trial time in an obstacle course race composed of a maze, spot obstacles, elevated cinder blocks, and a straightaway, which are meant to approximate real-world environments (hallways, furniture, trees, and rubble). The design seeks to be the optimal platform for completing the course as quickly as possible through the use of sensors to identify the optimal maze routing and avoid spot obstacles with a wheel-mounted jumping system to clear the final obstacle without slowing down. While this design serves purely as a competition vehicle, the project will act as a pathfinder for future autonomous vehicle design projects.

Autonomous Ground-Based Vehicle (Green Team)

Customizable to fit multiple purposes, this vehicle can avoid barricades, navigate through a maze, and traverse rocky terrain using its sensors, processing system and mechanical structures. The sensing system will detect obstacles while the processing system will register those obstacles and generate proper responses to either maneuver through or avoid them. The wheel system and chassis the vehicle to overcome multiple types of hindrance while maintaining speed and stability. Could be used for jobs requiring high repetition and precision in hazardous environments. Even with a low production cost, it maintains desirable features such as speed, reliability, efficiency, etc. and versatility.

Autonomous Ground-Based Vehicle (Red Team)

Self-navigates while detecting and avoiding obstacles. It traverses through a maze of linear barriers, and climbs onto and traverses on un-level/rubble-like surfaces. This vehicle demonstrates a rocker-bogie suspension which has no springs or stub axles for the wheels, allowing it to traverse over obstacles up to twice the size of the wheel diameter. To go over a barrier, the front wheels are forced onto the obstacle by the other wheels. The front wheels are then lifted up and over the obstacle, with the other wheels following until the entire vehicle is on the other side. The sensor array consists of ultrasonic sensors and inertial measurement units (IMUs). Manufactured for less than \$350, this vehicle can also be used inside buildings and hallways, assist in disaster relief, and more.

Autonomous Ground-Based Vehicle (Black Team)

A swarm-style vehicle able to operate without human intervention for use in search-and-rescue, reconnaissance, product delivery, exploration and more. This team set out to further validate this emerging technology. Specifically, the race-oriented nature of the competition highlights the vehicles' ability to complete a maze-like route as quickly as possible. Ensuring that driverless vehicles can successfully complete their routes in a timely manner without collision is an important milestone in the development.

Autonomous Ground-Based Vehicle (Gold Team)

This "Sensory Overload" design involves multiple ultrasonic sensors and real-time video to enable the vehicle to maneuver through unfamiliar environments. It uses computer code to process the input data from the camera and sensors to determine obstacle size and distance, then establishes appropriate maneuvers to avoid obstacles and navigate the environment. It can also operate by remote control. 3D printing was used to reduce prototype cost. Can be scaled up or modified with additional sensors to enable various applications specific to the user, including surveillance, pathfinding, search-and-rescue, bomb detection, fire detection/suppression and more.

Autonomous Ground-Based Vehicle (Silver Team)

This vehicle can navigate different environments while avoiding collisions, and travel as quickly as possible autonomously with ultrasonic and infrared sensors and a microcontroller. The vehicle adjusts its path of travel to take the most efficient path around obstacles. This is a unique three-wheel, reverse-tricycle design with two front wheels providing steering and one rear wheel providing power which offers less moving parts and comparable stability at high speeds when compared to traditional four wheel vehicle designs. The 3-D printed chassis architecture enables easy assembly and maintenance with replaceable off-the-shelf parts.

AIAA Ramjet Powered Vehicle

This team developed numerical simulations to solve for critical parameters and validate design decisions for a ramjet-powered vehicle. Ramjet engines are a simple, low-cost solution for supersonic propulsion, without complex turbomachinery and mechanical compressors. This team considered: Intake and Propulsion Subsystem Geometries; Solid Fuel Decision and Justification; Intake Simulation Software; Combustion Simulation Software; Overall Performance Software; Validating Simulation Results; Full Mechanical Assembly (CAD). This project can act as the payload for an existing and successfully flown AIAA solid rocket booster. The intent of this 'airbreathing' vehicle is to take in supersonic air and accelerate further into the supersonic regime.

Universal Robotic End Effector for Siemens

Capable of lifting, transporting, and placing down turbine blades and vanes of various sizes, weights, and geometries. This new end effector would be used as a robotic arm attachment to help automate the current process, reducing the time and cost to complete tasks. The machine clamps onto the blades and vanes securely lifting them from their resting point and moving them to a new location. Unique in its ability to pick up a wide variety of blades and vanes weighing from 12 to 45 pounds without being limited by the different geometries the parts might have. Could save thousands of hours and dollars overall, at the cost of a one-time manufacturing cost plus maintenance.

Drone Racing (Black Team)

A drone developed to compete for time and payload on-target delivery in the UCF Drone Racing Competition. This team focused on drone capabilities beyond typical payload release designs while maintaining competitive maneuverability and speed. With a limited budget, the cost-effective design balances maneuverability, speed, and payload performance. A Lidar Sensor Rangefinder is used to serve as the catalyst for autonomous payload release mechanics. A servo motor holds the spring-loaded payload in tension, which releases with activation of Lidar Sensor entering a pre-determined range of the target.

Drone Racing (Blue Team)

This team's drone achieves a balance of power, speed, and structural support within a budget of \$400. An affordable high-performance racing drone that excels in various environments and is easy to operate and service. An obstacle course tested its ability to fly vertically and horizontally, and drop a payload at a specified location. Modular frame pieces allow for quick repairs during operation. Frame material is composite wood for reliability and low cost. All electrical components were selected after considering an extensive competitor benchmark and industry standards analysis. The finalized concept verified all initial requirements.

Drone Racing (Gold Team)

A cost-effective durable drone designed for racing, this team's drone navigates a course with speed and agility, and has the technical capability to drop a payload on command at certain parts of the course. The team focused on achieving faster speed, smooth payload release, and maneuverability. Flying and long battery life were also important considerations. The competition involved obstacles to avoid as well as specified drop targets.

Powdered Metal Plasma Atomization

This team developed a system to use in metal 3D printing to bring the cost of the powder closer to raw material costs. The team designed a plasma atomizer that runs continuously to produce high volumes of metallic powder in a residential setting. This process is done via a non-transferred arc plasma torch that disintegrates a metal wire feed. These molten droplets fall in a tall tank filled with argon and solidify upon decent, forming spherical particles ideal for additive manufacturing. The goal is to have safe metallic powder as readily available as plastic filament is for standard plastic 3D printers.

Ology Height-Adjustable Desk Design Simplification for Steelcase

This team examined Steelcase's Ology workstation design to simplify aspects of the desk and reduce expenses by 20 percent. The height-adjustable desk is made for office use and provides the user's option to stand. The team considered a component redesign for manufacturing, product architecture, life cycle cost analysis, and logistics. Design modifications need to be nearly invisible to the customer yet maintain defined quality standards. The team considered combining, redesigning, and eliminating components of the desk, and factored in the logistics of manufacturing and assembly.

Transplanting Seedlings with a Robotic Manipulator

Reduces the man-hours and cost required for greenhouse operations with an affordable and simple solution of automating the task of transplanting young plants to larger trays as they grow. Scheduled transplants between growth stages optimizes the yield while minimizing the use of floor space. Transplanting is a tedious, yet mechanically simple task. This team designed and manufactured a decentralized robotic manipulator using 3D-printed components to reduce the initial cost of automation and maintenance, enabling a single supervisor to oversee and schedule sapling transplants.

High-Altitude Air-Launched Rocket

A faster and more affordable method to get small payloads into space with an unconventional first stage for the rocket: a high-altitude balloon that carries a launchpad and the rocket into the stratosphere (100,000 ft). At this altitude, the rocket launches off the launchpad and travels 40 miles passing the Karman Line and reaching space. With this method, a single-stage rocket can achieve such an altitude and deliver a small payload. This project is a proof-of-concept, where the rocket and high-altitude launchpad are tested separately.

Vertical Take-Off and Landing Hybrid Delivery Drone

An efficient, maneuverable drone that can deliver packages to the recipient's doorstep. This drone is a hybrid of a quadcopter (Multi-Rotor Flight Mode (MRFM)) and a fixed-wing UAV (Fixed-Wing Flight Mode (FWFM)). Capable of vertical take-off and landing, and can transition between MRFM and FWFM modes in mid-air. FWFM makes the aircraft more efficient when traveling between the warehouse and the customer's home, while also being very maneuverable when landing in MRFM to drop off the package. This design can eventually also be used for surveillance across flight as well as defense.

Micro Unmanned Aerial Vehicle (Blue Team)

This UAV system can carry an unstable payload for extended periods of time. Its multiple capabilities – camera, thermal imager and GPS – make it an economical solution for disaster relief, and search-and-rescue. Design considerations included how to maintain maneuverability in harsh conditions with an attached wireless camera and a GPS tracking payload. This system uses a backward facing motor and other electrical components to propel the UAV. Provides excellent durability, long range, and low-cost for the user.

Micro Unmanned Aerial Vehicle (Green Team)

A remotely-controlled air vehicle capable of carrying an irregularly shaped payload of up to 2 pounds. In practical applications this payload could be equipment for surveying or surveillance, and the project as a whole is intended to be a low cost platform that can be modified for a variety of applications. Its 'pusher' engine configuration and twin boom tail design set it apart from other conventional designs without creating unnecessary extra time or effort in regular maintenance work.

Micro Unmanned Aerial Vehicle (Red Team)

Carries a 2 pound payload, which includes the weight of attachments such as infrared cameras or fluid payloads. This UAV features a simple design: a pusher configuration with simple maneuverability of control surfaces which allows for effortless guidance through remote control. Within a small budget, this UAV's ease of manufacturing, assembly, and ability to carry fluids while maintaining stability are competitive features. Made with 3D printed parts. A router machine was used for precise wing cutting.

Micro Unmanned Aerial Vehicle (Black Team)

A push aircraft that carries a 32-ounce liquid-filled bottle around a designated course. This UAV has a miniature cargo system propelled by a one-directional motor mounted on the rear. This rear mounted motor and wing structure allows the UAV to achieve flight at a certain velocity and maintain this velocity throughout the flight duration. Parts are easily accessible for replacement unlike standard commercial UAVs. This provides a low-cost maintenance procedure in the case of catastrophic failure that results in rapid disassembly.

Micro Unmanned Aerial Vehicle (Gold Team)

This Micro UAV will compete with other design teams, and must be able to carry a bottle containing 32 fluid ounces of liquid and complete laps around a racetrack, to achieve maximum distance. Requires a “pusher” type propeller which impacts UAV’s overall design. Other design requirements include electric power, it must be a fixed wing aircraft, and compliant with all FAA regulations. Can be used for videography, payload transport, search and rescue, and more.

Micro Unmanned Aerial Vehicle (Silver Team)

A small UAV capable of achieving the greatest possible range while transporting a filled 32-ounce bottle as its payload. The final prototype resembles a standard aircraft with electrical propulsion. Built to compete in a race against two opposing teams to determine the optimal design. This UAV could later be adapted for the rapid and reliable transportation of consumer goods and other packages for major retail outlets.