UCF College of Engineering & Computer Science

FALL 2014 Senior Design Showcase

Friday, Nov. 21, 2014, 8 a.m. to 2 p.m., Engineering I and II atrium

Mechanical and Aerospace Engineering

1. **Airflow Thermal Control System** - Automating the home ventilation system to regular air flow through the vents and thus regulating the temperature in each room.

2. **Multi-Rotor Aero Project** – An unmanned aerial vehicle (UAV) that can vertically take-off and land for emergency search and rescue.

3. **Solar-Powered Mini Cooler** – Harnesses the power of the sun to keep food and drinks cool all day.

4. **Blood-Plasma Separator** – A cost-effective, disposable blood testing device for use in areas with limited resources. Removes white and red blood cells from plasma. Plasma reservoir would have a disease-detection sensor.

5. **Power Transmission Unit for a Windmill** – Low-cost gearbox to transfer the kinetic energy generated by a windmill to an irrigation pump and generator.

6. **Bundle Cutter Unit** – A device designed for aerospace company Technetics Group to cut cobalt or nickel alloy wire bundles more efficiently, uniformly and allow them to fall into place to be glued and soldered.

7. **Formula 500 Suspension** -- Rules for Formula 500 low-cost road racing cars require a puck suspension. This project modifies geometry and material of puck and washers to improve performance.

8. **Low-Cost Water Purification System** – Solar-powered device desalinates salt water and removes infectious pathogens using a pre-filtering method, reverse Osmosis and UV-C treatment.

9. **Improved Design of Bipolar Plate for Proton Exchange Membrane (PEM) Fuel Cell** – Project aims to create a more cost-effective and efficient fuel cell that turns hydrogen gas into clean energy.

10. **Fixed Wing/Blended Wing** – A blended wing aircraft that can fly for as long as possible in a single charge. Aircraft has a 4.5 foot wingspan that can carry 3-pound payload for more than 10 mins.

11. **Hand-Controlled Motorcycle Kickstand** – Controlled from the handlebars to assist mobility impaired riders, such as people with leg injuries.

12. **Gravity-Independent Delivery of Intravenous Fluids** – Could be used on long-term human space mission. Challenges to delivering IV fluids in microgravity include preventing air bubbles, fluid contamination, fluid motion and control and safety.

13. **ABB Switchgear Bus/Cable Compartment Assembly** – Design, fabrication, testing and implementation of a new hydrolic lift-and-tilt system to be used to assemble switchgears of multiple sizes.

14. **Low-Cost Agricultural Windmill** – A more affordable, easily repairable windmill that can produce 1 kilowatt of energy in low winds to power a water pump.

15. **Solar-Powered Portable Refrigeration System** – Efficient, self-sustaining, portable, solar-powered refrigeration system (no electrical outlet needed). Also features a sound system and can provide power for small electrical devices.

16. **3D Printed Deformable Lung Phantom** – A three-dimensional deformable lung that simulates in size, shape, elasticity and function a human lung. Breathing pattern is simulated with a flow-loop pump. The lung phantom will help radiologists develop quality standards for delivering radiation therapy to ultimately reduce the number of healthy lung cells that are damaged.

17. **3D Printed Pressure Vessels (Design, Analysis and Testing)** – Due to limited research on the 3D printing of pressure vessels, this project explores two designs: a spherical model; and an untraditional outer cubic shape with a traditional inner cylinder. Four vessels will be printed and tested for strength of different infill and layering.

18. **Diesel Engine Enhanced Power from Water, "HHO Boost,"** – Features a hydrogen-producing dry cell that produces HHO gas (hydroxy or oxyhydrogen) using hydrolysis. HHO is clean energy that is derived from water. System uses electrical current to rip apart the molecular bond of a water molecule, resulting in combustible gas. Will be used as a supplement to a diesel engine. Research shows production of two liters of HHO gas per minute and a fuel economy of 35 percent.

19. **A More Efficient Water Heater: Porous Media Combustion Chamber** – Extracts heat from combustion a mixture of methane gas and air within a porous silicon carbide material, a process that has been shown to produce lower emissions than free-flame combustion. Also features higher thermal efficiency.

20. **Repurposed Satellite Dish as Solar-Powered Generator** – Small-scale generator for individual homeowner's use. Has a reflective film on the dish surface. Salt is used as a heat capacitor in the thermal collector. Thermal energy is transferred to water flowing through a spiral copper pipe, and converts steam into mechanical/electrical power.

21. **Deep Water Well Pump** – To use in places with limited resources. Features a pulley system and pistons. At the well bottom, the space between the pistons fills with water. Water is carried upward and emptied at the top of a pipe. Powered by a windmill.

22. **Scuba Rebreather** – Device extends the time a diver can spend underwater. Diver can switch from semi-closed to closed circuit mode, which can be used in cases of electronics failure to help diver safely return to the surface without relying solely on bailout oxygen tank.

23. **Human-Powered Water Pump** – Easy-to-use, portable pump that attaches to a bicycle for irrigation. Intended to help people in countries who have limited ability to pay for expensive irrigation equipment.

24. **Low-Cost Hospital Bed** – An affordable and sustainable bed design for use in developing countries. Bed features head and foot inclines; simple mechanisms with low-cost materials that are readily available around the world. Bed is designed to be adjustable; portable; safe; non-electric; reliable and more.

25. **Integration of Corrugated Wing Core for Composite Wing Structure** – A new wing structure design to simplify the internal components of a traditional aircraft wing. Goal is to reduce weight and allow for efficient mass production that can be adapted based on customer specifications.

26. **Swirl Pot Efficiency Enhancement Design (S.P.E.E.D.)** – A swirl pot is part of a formula engine's cooling system that increases efficiency by removing excess steam from the water flowing through the engine. Different models were created and tested; the most effective one prototyped and displayed.

27. **Design/Construction of Low-Friction Bearing** – Increases the lifespan of a bearing compared to traditional ball bearings, using magnetism to create a field which allows the rotating shaft to spin with minimal contact. This design reduces load and wear on the shaft being rotated. Intended use is in power plants, where the operating condition of the machinery is critical for productivity.

28. **WAKE System** – Optimizes an oscillating water column to maximize velocity.

Project #41: **Waste Heat Recovery Using Thermo-Electric Materials** – Harnesses the thermal energy expelled by exhaust system of an internal combustion engine and coverts it to electrical energy.

Electrical and Computer Engineering

29. **Cost-Effective Panoramic Infrared Camera** – This system is several thousand dollars less costly than current panoramic camera solutions on the market. Uses a single camera on a rotating axis and image stitching technology, vs. using several cameras that take pictures simultaneously.

30. **Computer-Vision Assisted Firearm: Deployable Autonomous Defense System** – A turret that autonomously protects an area from threats using computer vision technology. (36" long, 18" wide, 26" tall). Designed based on the load and operation of a military standard rifle weapon system. Advantage is that it does not rely on external systems to identify and acquire potential foes.

31. **JamDroid: An Electro-Mechanical Guitar** – Perfect for the "musically talentless," this electric guitar can be programmed to play songs on its own.

32. **Lost & Found Child: A GPS/GSM Tracking Device** – Project features two parts: a device to be worn on the child and an app for the guardian's mobile device. Device tracks and sends the child's coordinates to the guardian, and can also point the child to the guardian.

33. **Sound Arrow: Using Facial Tracking to Send Directed Audio Sound Beam** – Contains roughly 100 transducer speakers that send audio in the ultrasonic frequency range, to allow for sound to move in a straight direction and not disperse. Uses facial tracking technology to direct audio to only a specific recipient. This could mean a person watching TV can hear the audio without others in the room hearing it.

34. **Short Range 3D Scanner: "SR3D" Using Computer Vision** – Recreates physical objects into detailed digital representation. Scanner costs almost 70 percent less than 3D scanners on the market, and it scans about 20 percent faster. Portable, energy-efficient system uses an enclosed camera, laser, stepper motor and rotating platform for the object.

35. **NOAA Weather Satellite Receiver** – Capable of receiving satellite images from the National Oceanic and Atmospheric Agency weather satellites, primarily for radio hobbyists. This system processes the data and creates an image on the user's screen. Requires only power and line of sight to the satellite.

36. **Portable Emergency Desalination System (PEDS)** – Low-cost, easy-to-use system that collects a small sample of seawater and uses a battery-powered distillation method to produce clean drinking water. Has a solar panel. Could be scaled up to provide remote towns with clean, drinkable water.

37. **Using Smart-Phone to Remote-Control a Model Car** – Users won't have to look at the car to operate it; the car has a mounted smart-phone that transmits live-video stream back to the user.

38. **SecLock: A Secure SmartCard Reader** – This reader/card system seeks authenticity and also issues a challenge to the card to check for uniqueness. Typical RF readers only check for authenticity, which can be duplicated by another device within the area. This system is easy for the user but extremely difficult to breach.

39. **The Selfie: Robotic Cameraman** –The Selfie has a camera base that holds the user's camera and uses motors that aim and point the camera in the proper direction, by interacting with one of two devices worn on the user. An infrared device is for indoor use; and a GPS device is for outdoor use. A user could record themselves in sports, theatre, speech delivery, and more for practice and improvement.

40. **Knight Eagle Quadcoptor** – Numerous features in one autonomous flying device, including tablet control, onboard camera, collision detection, and airsoft machine gun. The gun hopper could be loaded with many types of pellets including paintball, and even pepper spray pellets for hostile/riot situations.

41. (Listed under Mechanical and Aerospace Engineering projects)

42. **Electronic-Enhanced Cornhole with Scoring System** – Players can enjoy the game while a camera and sensor track the corn bags and sends the score to a wireless scoreboard. System also uses sound and visual animations to enhance the experience. Lasts up to 12 hours.

43. **Spotter 1000: Find Open Car Spots or Class Seats** – System observes a parking lot and a classroom with three-cameras, determines exact locations of spaces or seats that are taken and free, and sends the information to an app that is accessed with a smart phone. Uses low-cost components and the data is updated every minute.

44. **iLidar – Inexpensive Light Detection and Ranging** – Sensor unit scans surrounding surfaces in a 180-degree window. iLidar uses triangulation instead of time of flight, so inexpensive components can be used. Sensor, which can be fitted for robotic platform, is battery operated and can continuously scan for up to two hours at 30 frames per second.

45. **Voice-Controlled Chess: Knights of the Chess Table** – Pieces move with voice commands. Play against another person or the game's artificial intelligence. This game's AI can also battle itself. Beginning chess players can ask for help and the possible moves will be illuminated.

46. **NOKI: Smart Door Lock** – Features a keyless Bluetooth entry, a display that shows weather and reminder alerts that can be set from a mobile phone, and has a security camera with motion detector that sends notification when an unknown user approaches the door. Powered with four standard AA batteries that can last up to a year.

47. **Falling Liquid User Interactive Display (FLUID Image)** – A large, doorframe-like structure that drops water using a small computer to display an image as the water falls. Commercial "water wall displays" cost at least $2,000; this design costs $600 to $800.

48. **Watch Emergency Response ("The WatchER)** – A smart watch that connects to a home alarm system and informs the homeowner when alarm is set off. Intended for use by hearing-limited/deaf persons. Transmitter sends a signal via Bluetooth to the watch and displays a warning and vibrates. Possible applications include home alarm systems, fire alarms and carbon monoxide alarms.

Industrial Engineering & Management Systems

49. **Improving Efficiency in Houston Tooling Supermarkets for Siemens** – To reduce the delay in Siemens getting certain materials for tool kit replenishment from an outside vendor, this team set out to reduce waiting times, reduce excess inventory and make inventory at the user's location visible to the person performing the tasks.

50. **Orlando VA Medical Center** – This team has provided practical insights, procedures and management tools for clinical services to make real-time adjustments to their supply and demand to minimize veteran wait time and maximize clinical efficiency. The improvements take into consideration the pending facility move to Lake Nona.

51. **Costing System Upgrade for Genesis VII, Inc**. – This team set out to improve the client's internal management/tracking system for contract procurement. Present system cannot create basic graphic charts to show how well the business is performing. This team updated the procurement system and modified the costing system to eliminate deficiencies, and provided a user-friendly system.

52. **Houston Tooling Yard Organization for Siemens** – To reduce disorganization at the tooling facility regarding the movement of items in the yard area, this team will propose a system that reduces excess motion, transportation and inventory levels. The group will streamline operations to improve efficiency.

53. **Walt Disney World Manufacturing** – The team assessed the manufacturing work flow within Central Shops, and developed recommendations regarding use of space, material handling, process improvements, work in process inventory and visual management.

54. **Florida Hospital for Children Performance Improvement** – This team analyzed operations and provided recommendations in the Children's Emergency Center where capacity has been tested in recent years. By assessing seasonal trends, variation and growth rates, the group advised management about future growth and whether new construction should be built to accommodate.

55. **Florida Hospital Performance Improvement Department** – This team recommended ways to improve the flow of patients from arrival to pre-op area to increase efficiency and utilization of the Operating Room.

56. **Parrish Medical Center** – This team was tasked with improving the flow of patients through the emergency department. The intent is to promote full-capacity use of equipment and facilities by reducing bottlenecks, and to develop a smooth flow of patients, materials, work and communication.

57. **General Electric Intelligent Transportation Solutions** – This team developed the processes and tools to perform overall laboratory management. They were tasked with helping the client achieve an automated information system/tool for laboratory owners to manage all aspects of GE laboratories in Melbourne, Jacksonville and Grain Valley, Mo.