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College of Engineering Senior Design Competition Spring 2008

University of Nevada, Las Vegas

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Celebrate

the spirit of innovation…

Spring 2008
Senior Design Competition
FRIDAY, MAY 9, 2008

UNLV'S HOWARD R. HUGHES
COLLEGE OF ENGINEERING

Spring 2008
Senior Design Competition

Part of every UNLV engineering student's academic experience, the senior design project stimulates engineering innovation and entrepreneurship. Each student in their senior year chooses, plans, designs, and prototypes a product in this required element of the curriculum. A capstone to the student's educational career, the senior design project encourages the student to use everything learned in the engineering program to create a practical, real world solution to an engineering challenge.

The senior design competition helps to focus the senior students in increasing the quality and potential for commercial application for their design projects. Judges from local industry evaluate the projects on innovation, commercial potential and presentation quality. One overall winner, two winners from each discipline, and one multi-disciplinary winner (when applicable) are chosen and receive cash awards and commemorative plaques and medallions.

The competition has generated significant interest from the local community, and has provided additional motivation for students to be innovative and to produce quality projects.

History

In 1999, the Entrepreneurship Club (E-Club) of the College of Engineering began sponsoring the Senior Design presentation event. The E-Club has been actively pursuing the goal of integrating entrepreneurship with engineering curriculum through seminars and facilitating senior design projects. In 2001, the E-Club conducted its first senior design competition. This opened the senior design event to Civil and Environmental, Electrical and Computer, and Mechanical Engineering students.

The E-Club itself, the senior design projects and the competition all encourage students to become entrepreneurs upon graduation and contribute to the College's role in the economic diversification of the southern Nevada area.

The Awards

Beginning in 2002, College of Engineering supporters Harriet and Fred Cox have generously provided for the Harriet and Fred Cox Engineering Design Award to be given to the top outstanding projects in the senior design competition. Ongoing support for the awards has been established by their endowment gift to the College. The founder of four corporations — Emulex Corporation, Manufacturers Capital, California Data Processors, and Microdata Corporation — Fred Cox knows the value of entrepreneurship very well, and he and his wife Harriet are delighted to support the College of Engineering and our students in this significant venture.

A special dinner in the spring celebrates the students' achievements and provides their families, faculty, and the greater Las Vegas community an opportunity to share in the excitement of the students' work.

Instructors for Senior Design Program:

Dr. Walter Vodrazka – Department of Civil and Environmental Engineering
Dr. Paolo Ginobbi – for the Department of Computer and Electrical Engineering
Dr. Zhiyong Wang – Department of Mechanical Engineering

E-Club Faculty Members:
Dr. Laxmi Gewali
Dr. Henry Selvaraj
Dr. Rama Venkat
Dr. Zhiyong Wang

A Special Thanks to Our Senior Design Industry Judges:

Bradford Colton
Research Engineer, Halotron Division
American Pacific

William O'Donnell
Research Associate
UNLV, Physics and Astronomy

Samuel D. Palmer, P.E., C.E.M.
Senior Vice President
Western Operation Group Manager
Terracon Consulting Engineers & Scientists

9:00–9:30 a.m.

Grassroots Irrigation Solutions

Department of Civil & Environmental Engineering
Project Participants: Steven Bise, Kevin Bross, Michael Cunningham, Chad Nikaido, and Robert Olds
Instructor: Dr. Edward Neumann
Faculty Advisor: Dr. Barbara Luke
Community Mentors: Dr. Dale Devitt & Mr. Bill Rohret

Grassroots Irrigation Solutions is proposing the design of a subsurface irrigation system for golf course problem areas. The need for such a system stems from the fact that although golf courses irrigate with 85-95% precision, problem areas such as hillsides often need to be over-watered to compensate for surface runoff. A direct result of this over-watering practice is that the bases of the hillsides become flooded.

Our system is designed to eliminate this surface runoff problem by injecting the water into the root zone of the turf. By directly supplying water to the root zone, our system will be able to deliver the correct amount of water while eliminating any flooding caused by surface runoff. More importantly, this system is designed to work in unison with the existing sprinkler system so costs of installation will be minimized.

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9:15–9:45 a.m.

Open

NOTES: _____

9:30–10:00 a.m.

InfoSafe – The USB Drive with a Plus!

Department of Electrical & Computer Engineering
Project Participants: Sarah Q. Chatterjee
Instructor: Dr. Paolo Ginobbi
Faculty Adviser: Dr. Paolo Ginobbi
Community Mentor: Mr. Glenn Mercier

In a world where digital storage has become an integral part of society, security of information has become more complex and necessary. InfoSafe is a USB Storage Device that is enabled and disabled by a radio frequency (RF) signal. This is a way to add an extra layer of protection to deter holders of lost or stolen USB devices from being able to easily access the stored information.

The project involved the development of a USB storage device that includes an Atmel microcontroller to handle multiple inputs and outputs. A radio frequency transmitter and receiver allow the InfoSafe to be enabled only when they are within five feet of each other. The module used for the main storage location was ferroelectric random access memory (FRAM).

This is a nonvolatile memory that was implemented for its ability to accommodate high speed read and write cycles and a high number of read and write cycles while maintaining low power consumption. Additionally, because the EEPROM of the microcontroller has password protection capability, it can be utilized as a safer location to store sensitive information like codes or passwords.

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9:45–10:15 a.m.

Green School Project

Department of Civil & Environmental Engineering
Project Participants:
Instructor: Dr. Edward Neumann
Faculty Adviser: Dr. Edward Neumann

The Green School project is an attempt to design an elementary school that will be more energy efficient and water smart than existing elementary schools. In order to conserve energy, the school will be designed an earth-sheltered structure. In order to generate additional energy savings, a combination of reflective roofing, high-efficiency lighting ,and geothermal heating/cooling will be used. The school will also be designed with water smart landscaping and other water-saving measures. With the implementation of these "green" building features, the team hopes to achieve LEED certification standards. As an added bonus, the school will have an integrated educational program. Students will learn about each major energy and water-saving feature through age-appropriate activities and displays, with the hopes of raising public awareness and promoting a future generation of environmentally-conscious individuals.

NOTES: _____

10:00–10:30 a.m.

RFID Security System

Department of Electrical & Computer Engineering
Project Participants: Ruben Carrillo, Derek Denham, and Juan Rivera
Instructor: Dr. Paolo Ginobbi

The purpose of this project is to develop a Radio Frequency Identification (RFID) security system for small businesses. With the economy in a slump, small businesses can ill afford to take a financial hit, let alone suffering large expenses for security purposes. With this cost-effective product, businesses can implement this security system without facing a financial burden while protecting their assets.

This project uses RFID tags and each tag has a unique binary code stored in the card. These cards are placed next to the reader (which is the antenna), and the reader determines whether the card holder can gain access or not. Each card's code is stored into a program which determines accessibility to the card holder.

The card holder will then know whether access was granted or denied by a lit red or green light emitting diode (LED).

NOTES: _____

10:15–10:45 a.m.

Motorized Palm Tree Trimmer

Department of Mechanical Engineering
Project Participants: Michael Morgan, Hilary Shyface, and Daniel Skoblar
Instructor: Dr. Brian Landsberger
Faculty Adviser: Dr. Mohammed Trabia

Landscape maintenance can be time consuming and tedious. Current palm tree trimming tools require strenuous effort and many times are limited in the operations they can perform. Many homeowners and landscaping companies are looking for the next generation in power tool to make their job easier.

The goal of this project is to improve upon existing tree trimming tools, by reducing the stress and work required by the worker. In many cases, this will eliminate the need for ladders and foot spikes normally used by palm tree maintenance workers. The improvement should also increase in safety of the worker.

The team designed a motorized palm tree trimmer with extendable pole that can easily remove palm leaves. The trimmer utilizes a dual blade cutting technique that cuts palm leaves at a fast rate and eliminates most vibration characteristic of a single blade cutter. The cutter was made cordless by utilizing a standard commercial battery pack. Different blade speeds, cutting tooth patterns, and oscillation amplitudes were tested for performance improvement and optimum levels were selected. With the motorized Palm Tree Trimmer, we provide a single user operated machine that can replace existing tools with a safer, easier and quicker solution.

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10:30–11:00 a.m.

Speedboat Cruise Control and Monitoring System

Department of: Electrical & Computer Engineering
Project Participants: Itai Leshniak and Derek Martinec
Instructor: Dr. Paolo Ginobbi

The goal of the Speedwatch cruise control system design is to reactively control boat speed for cruising and water sports. In addition, the project is able to monitor important boat characteristics and warn the user if there exist any problems.

In water sports in particular, maintaining a constant speed is important to the safety and success of the skier and can be difficult to obtain by manual human operation. The system is touch panel operated and has sensors running to the boat's engine and other important areas. The main control apparatus itself consists of a display with touch panel and associated circuitry which are mounted inside the boat's dashboard.

For the actual implementation a microprocessor is used which must monitor and adjust speed while simultaneously monitoring critical boat attributes (such as engine temperature for example.) The microprocessor uses a PID (Proportional Integral Differential) control algorithm to handle the engine speed and feedback system. Display and touch panel functionality is also done by the microprocessor. To interface with the system a friendly user interface has been developed complete with menus and many settings to give the user control over how the system looks and feels.

NOTES: _____

10:45–11:15 a.m.

UAV Variable Wing

Department of Mechanical Engineering
Project Participants: Donald Borchardt, Luis Durani, and Ray Poyaoan
Instructor: Dr. Brian Landsberger
Faculty Adviser: Dr. Brendan O'Toole

The U.S. Air Force needs an Unmanned Aerial Vehicle (UAV) that is maneuverable in tight spaces, and is very compact for landing, take off, and transportation. UNLV is addressing that need with a folding wing UAV and this project has designed the wing folding and locking mechanism for that UAV.

This is the first military UAV to have motorized folding and locking wings. Critical project goals include enabling the UAV to enter a 50" wide passage way, fold and lock the wings in less than 10 seconds, and be as light as possible to minimize weight effects on aircraft flight performance.

Within the fixed wing root is a securely mounted folding linkage mechanism operated by an electric linear actuator with position feedback control. The translational motion of the actuator rod is converted to rotational motion by the linkages. Once the wing is in its final position, a second linear actuator locks the linkage to ensure the wing stays in place. Both the folding and locking actuators are computer controlled in the actual UAV.

A Design of Experiment (DOE) analysis was performed to achieve an optimum design that could achieve the project objectives even when exposed to different dynamic flight conditions.

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11:00–11:30 a.m.

Dragonfly Aircraft

Department of Mechanical Engineering
Project Participants: Justin Borres and Sandra De La Cruz
Instructor: Dr. Brian Landsberger
Faculty Adviser: Dr. William Culbreth
Miniature unmanned vehicles (MAV) have the potential to be a novel and excellent means for surveillance inside buildings and over shot distances outside. The Defense Advanced Research Projects Agency (DARPA) has initiated project competitions for MAV with three different designs: fixed wing aircraft, helicopter, and flapping wing aircraft resembling the flight mechanisms of many insects.

Key project goals include flying through a 1-meter-square window into a 3.6-meter square room and send video back to the controller that enables recognition of objects inside the room.

The team, starting with a toy dragonfly, developed a radio-controlled dragonfly that can perform remote video surveillance in small interior rooms. A unique advantage of the flapping wing option is the ability of the aircraft to sustain minor impacts into walls and other surfaces without damage or loosing flight control.

A miniature video camera with remote real-time telemetry mounted in the aircraft nose is used for both flight control vision and target identification. To enable holding the camera on target, control of forward motion was accomplished using center of gravity shifting. The overall design was optimized for maneuverability, ruggedness and high thrust to weight properties.

NOTES: _____

11:15–11:45 a.m.

Electronic Rubik's Cube

Department of: Electrical & Computer Engineering
Project Participants: Fiacadie Engida, Frank A. Scarpa Jr., and Thomas D. Wood.
Instructor: Dr. Paolo Ginobbi
Faculty Adviser: Dr. Paolo Ginobbi

Our project is the design and construction of an electronic Rubik's cube. This electronic device simulates the movement of the rows and columns on a regular Rubik's cube using LEDs. During normal operation the cube is held in hand and the colors will change when one slides their finger across the row of lights that they want to move. Additionally, the cube has the ability to scramble and solve itself based on user input.

This design is an electronic version of the regular rubrics cube. It differs immensely from the electronic device called "the Rubik's revolution" which is currently on the market.

The Rubik's Revolution is nothing but a game shaped like a cube and does not function specifically like a Rubik's cube.

Our design is original; we designed an algorithm based on the functionality of the standard Rubik's cube. Based on that algorithm, we wrote the software to control our designed digital system consisting of multiple micro controllers, logic circuits, and IC's. Also, we designed and built our own touch sensors to control the movement of the rows and columns of the cube.

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11:30 a.m.–Noon

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1:15–1:45 p.m.

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1:30–2:00 p.m.

Mechanical Torque Limiter

Department of Mechanical Engineering
Project Participants: Kevin Murphy and Jesse Roll
Instructor: Dr. Brian Landsberger
Faculty Adviser: Dr. Mohammed Trabia & Dr. Woosoon Yim

In many of today's automotive repair shops and even household garages, much time is spent torque setting nuts and bolts to the correct specifications. Current market torque setting devices are generally too sensitive or inconvenient to also be used as the primary bolt turning tool. Other existing torque setting tools can take a lot of time to properly connect to power wrenches.

The purpose of this project is to provide a versatile, robust and time saving single-tool torque setting solution for the worker or private mechanic.

Our product streamlines the torque setting process by providing an adjustable, accurate, mechanical torque limiting attachment. The attachment possesses the stout capacity of standard ratcheting and wrenching tools. The product uses a unique radial ratcheting tooth interface that allows the user to perform common wrenching and accurate torque setting without fear of damaging a sensitive tool. The user also saves time since no tool switching is required. With our Mechanical Torque Limiter, we hope to replace many tools in the American toolbox with one multi-purpose device.

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1:45–2:15 p.m.

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2:00–2:30 p.m.

High Performance Brakes

Department of Mechanical Engineering
Project Participants: Abraham Usi and Victor Villa
Instructor: Dr. Brian Landsberger
Faculty Adviser: Dr. Brendan O'Toole
Community Mentor: Mr. William K. Nelson / Pioneer Technologies, LLC

Several of Audi's sports cars lack aftermarket braking components that are essential when other high-performance components are added to the car. Only front aftermarket brakes currently exist for a few of Audi's models, and many of them are costly.

The goal of this project is to develop a complete front and back high-performance brake kit specifically for the 2002 Audi S6 Avant. The project sponsor, Pioneer Technologies, LLC, anticipates a profitable market for this and additional components for several of Audi's sports cars.

Addressing customer and business needs, the brake kit developed incorporates both front & rear assemblies, at relatively low cost. The team manufactured custom brake adapters and disk brake wheel hats to adapt precision existing aftermarket brake calipers and disk rotors. To meet performance needs, directional-veined rotors and Porsche calipers were used to complete the brake kit, resulting in improved cooling and more responsive braking power. A unique rear bracket design enabled both the Porsche calipers and StopTech emergency brakes to mount onto the rear assembly. Road testing on the actual S6 Avant was used to optimize brake components and adjustment levels.

NOTES: _____

2:15–2:45 p.m.

Open

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Schedule of Senior Design Project Presentations
Thomas Beam Engineering Complex, Great Hall
May 7, 2008

2:30–3:00 p.m.

Open

NOTES: _____

2:45–3:15 p.m.

Gas Heat Pump Water Heater

Departments of: Electrical & Mechanical Engineering (Interdisciplinary project)
Project Participants: David Carey, Matthew Fagin, Kevin Hinderliter, and Lillian J Ratliff
Instructor: Dr. Brian Landsberger, Dr. Paolo Ginobbi
Faculty Adviser: Dr. Bob Boehm, Dr. Paolo Ginobbi
Community Mentor: Team Consulting LLC.

The driving force for the water heater project is the need for a more efficient water heating method. Studies show that the most promising way to achieve this is to utilize a heat pump. Heat pumps run with great efficiencies because the primary energy source for heating the water is gathered from the ambient air. The costly fuel source is only used to provide the work needed to transfer heat from ambient air to the heating medium via a compressor, comprising only a third of the overall energy output.

The purpose of the project is to develop a product, which provides hot water, while addressing the energy crisis. By employing a natural gas engine and its heat byproducts as the heat pump's driving-energy source, this project will double the water-heating output-to-input ratio of gas water heaters, and bypass the transmission losses and power plant inefficiencies associated with electric water heaters. The development and implementation process included the design and analysis of component selection and integration.

Thanks to the incorporation of differing engineering disciplines and excellent teamwork, the project is currently operating with goal-surpassing efficiencies, capacities, and temperatures

Schedule of Senior Design Project Presentations
Thomas Beam Engineering Complex, Great Hall
May 7, 2008

3:00–3:30 p.m.

Open

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3:15–3:45 p.m.

Open

NOTES: _____

3:30–4:00 p.m.

Livestock Monitoring System

Department: Electrical Engineering
Project Participants: Gavin Burke and Dalton Turnbow
Instructor: Dr. Paolo Ginobbi

Our project will allow ranchers to locate livestock, mainly cattle, simply by looking at a computer screen. The screen will show a map of their land and the location of each animal. The information on the screen will refresh every ten minutes.

The purpose of this project is to save the rancher a lot of time and money. It will save time because the rancher will know, within ten minutes, when a cow gets on the other side of the fence due to the cow not appearing on the map. It will save money because when a cow is going into labor it will wander off by itself to give birth. The rancher will be able to see this on the map and will be able to go out and assist the cow giving birth. This will greatly increase the survival rate of the calf and the mother.

We will accomplish this by using a GPS system set up with a tower requesting information from the device on the cow. This device then turns on and sends the GPS data back to the tower which will then send it to a hub. The hub will then display the location of the cow on the computer screen.

NOTES: _____

3:45–4:15 p.m.

Sun City Solar Water System

Department of Civil & Environmental Engineering
Project Participants:
Instructor: Dr. Edward Neumann
Faculty Adviser: Dr. Edward Neumann

Solar water heaters for swimming pools are large black systems that cover a large area on top of the roof .These systems are ugly and most homeowners associations are picky about where on the roof you are allowed to put them.

These systems are generally made of plastic and rubber or just plastic Neither the plastic nor the glue that connects the plastic holds up well under extreme desert heat.

We plan to create a new design that lasts longer and looks better.

NOTES: _____

Congratulations!

We hope to see you at the May 9, 2008 Senior Design Dinner where your winners.


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