


5-3-2006

## College of Engineering Senior Design Competition Spring 2006

University of Nevada, Las Vegas

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CELEBRATE THE SPIRIT OF  
ENTREPRENEURSHIP...

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SPRING 2006  
SENIOR DESIGN COMPETITION

*The Howard R. Hughes  
College of Engineering*

MAY 3, 2006

**UNLV**  
UNIVERSITY OF NEVADA LAS VEGAS

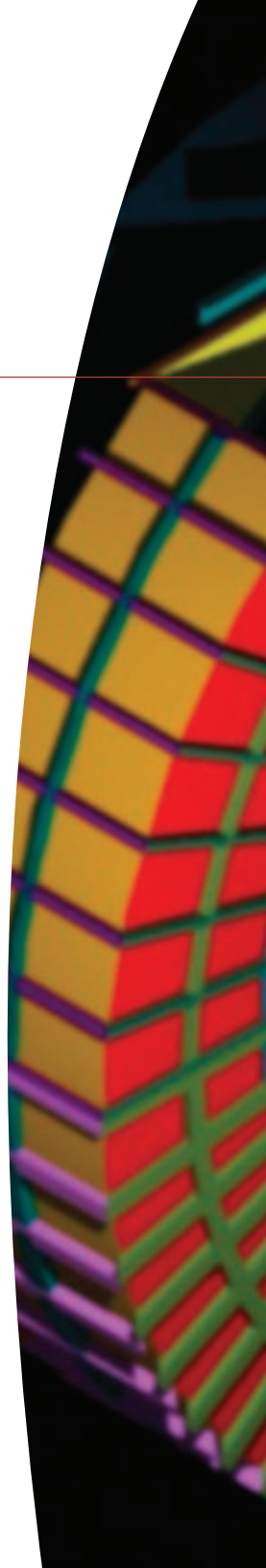


Image courtesy of Phoenix International, Inc.

# SPRING 2006

# SENIOR DESIGN COMPETITION

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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 Electrical, Computer, Mechanical and Civil 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. Shashi Nambisan – Department of Civil and Environmental Engineering  
Bill O'Donnell – 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:**

Michael Blois, Manager of Value Engineering  
Bechtel SAIC Company

Blake Gover, Director of Electronics Engineering  
Young Electric Sign Company(YESCO)

Ronald Hill, need title  
Washington Group

Robert L. Mendenhall, CEO  
Las Vegas Paving Corporation

SCHEDULE OF SENIOR DESIGN PROJECT PRESENTATIONS  
THOMAS BEAM ENGINEERING COMPLEX, GREAT HALL  
MAY 3, 2006

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**9:00 a.m. – 9:30 a.m.**

**Blowdown Water Treatment and Reuse**

Department of Civil and Environmental Engineering  
Project Participants: Zachary Hills, Holly McNaught, and Cheryl Ruayan  
Instructor: Dr. Shashi Nambisan  
Faculty Adviser: Dr. Felipe Gutierrez and Dr. David James  
Community Mentor: Ms. Erika Moonin

**Abstract**

TEAM 6 Consultants evaluated cooling tower and blowdown water treatment options, recommended a treatment method, and designed a reuse distribution system for irrigation at the Molasky Corporate Center to be leased by the Southern Nevada Water Authority (SNWA). Design parameters utilized to achieve irrigation water quality and quantity compatible with the building landscape design and acceptable to SNWA included: Leadership in Energy and Environmental Design (LEED) compliance, water and energy conservation, educational benefits, capital costs, and operation and maintenance costs. The recommended primary treatment alternative for the constituents within the cooling towers is a non-chemical, electromagnetic pulsed power treatment system (Dolphin) manufactured by Clearwater Systems. A reverse osmosis system was recommended as the secondary treatment for the blowdown water released from the cooling towers and thereby reclaimed for irrigation use. Finally, an extensive hydraulic analysis was performed to design the blowdown collection and reclaimed water distribution system for landscape irrigation at both the ground and seventh levels of the building.

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**9:15-9:45 a.m.**

**SODIST+: A Disinfection Strategy Combining Solar Disinfection and Organic Acids**

Department of Civil and Environmental Engineering

Participants: Camille Calimlim and Rob Davies

Instructor:

Faculty Adviser:

**Abstract**

Not yet received

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**9:30-10:00 a.m.**

**Solar UAV**

Department of Mechanical Engineering

Participants: Joshua Alves, Louie Dube, and Corey Ohnstad

Instructor: Dr. Zhiyong Wang

Faculty Adviser: Dr. Darrell Pepper and Mr. John L. Vogt

**Abstract**

This system brings solar powered flight to the Radio-Controlled (RC) hobbyist as well as any other type of business venture, such as surveillance or scientific research, which might benefit from solar powered flight at an affordable price. This project relies on the synergy of several subsystems to achieve its purpose, including a completely original airframe, a power system with off-the-shelf parts and an electrical charging system which harnesses the photovoltaic cells' power and feeds it into the control and power systems. Solar power allows for extended loiter time and has been used on large scale projects to provide almost indefinite flight time but has never been marketed on a smaller scale, such as what as been provided by this project.

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**9:45 a.m.-10:15 a.m.**

**UNLV Master Plan-Phase I**

Department of Civil and Environmental Engineering

Participants: Brian D. Allen and Kellin Luong

Instructor: Dr. Shashi Nambisan

Faculty Adviser: Dr. Mohamed Kaseko

**Abstract**

The University of Nevada Las Vegas is growing so there is a need to find innovative ways to accommodate the increase in vehicles entering and exiting the main campus. The goals of this design project are to generate alternatives for traffic circulation improvements, to determine the most ideal improvement, to perform a hydrologic and hydraulic analysis of the selected improvements, and to produce civil plans for the project site. The project site is located on the northern part of the main campus which includes the Flamingo Access Road, Cottage Grove Avenue, and the utility road around the soccer fields. The analysis and improvements are based on the University of Nevada, Las Vegas Master Plan Report and the expected growth of the University. Alternatives are generated based on existing and the expected future vehicle traffic. To establish the most advantageous alternative a decision matrix will be utilized to rate the alternatives on level of service, cost, aesthetics, public acceptance, and improvement life. Once an alternative has been selected, the geometric design, hydrologic, and hydraulic analysis of the improvements will begin. Ultimately, the civil plans will include traffic control, grading, and plan and profile sheets of the improvements.

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**10:00-10:30 a.m.**

**Rapid Beverage Chiller**

Department of Mechanical Engineering  
Participants: Michael Flores and Aaron Sahn  
Instructor:  
Faculty Adviser:

**Abstract**

Not yet received

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**10:15-10:45 a.m.**

**Heat Wave Water Park- Water and Wastewater Design**

Department of Civil and Environmental Engineering

Participants: Elicia Kettles, Keith Letus, and Jen Nuesca

Instructor: Dr. Shashi Nambisan

Faculty Adviser: Dr. Thomas Piechota

**Abstract**

T2 is designing the water and wastewater systems for a proposed Heat Wave Water Park at the northeast corner of Durango Drive and Robindale Road in Clark County, Nevada. The design must meet the demand to operate every ride in the park, as well as auxiliary buildings such as restaurants and rest-rooms. Adequate pressure levels must be achieved to operate slides and other water attractions throughout the site. The most economical design is desired. Therefore, an economic analysis of reusing treated wastewater for landscaping will be considered.

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**10:30-11:00 a.m.**

**Title: Automatic Can Crusher**

Department of Mechanical Engineering  
Participants: Paul Pigman and Rob Santos  
Instructor: Dr. Zhiwong Wang  
Faculty Adviser: Dr. Mohamed Trabia

**Abstract**

The concept of our design is fairly simple, but could be extremely effective. What we have brainstormed is a compact receptacle, no larger than a medium-size plastic trash bin. Powered by a small DC motor, this mechanism will safely compress an average sized soda can and dispense it into its receptacle below in a matter of seconds. The purpose of this design is to minimize garbage space. This method of crushing cans may be used as a tool to motivate consumers to recycle.

Our main focus for this design is the average college student, who, from past experience, likes to consume canned beverages frequently. Students typically live in smaller living quarters, such as residence halls or one to two bedroom apartments. Living in this situation tends to leave little room for trash to be lying around. With this new invention, students can focus on other activities instead of spending there time cleaning their living quarters. Eventually, we plan on taking this idea to a larger crowd, extending upwards to concerts and sporting events that like to minimize waste disposal.

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10:45-11:15 a.m.

## CETON

Department of Mechanical Engineering

Participants: Timorothy Beller, Brice Howard, Ryan LeCounte

Instructor: Dr. Zhiyong Wang

Faculty Adviser: Dr. Denis Beller

### Abstract

The Cooled Electron Target Optimized for Neutron-production (CETON) is an extension of the Reactor-Accelerator Coupled Experiments (RACE) currently being conducted at the Idaho State University Idaho Accelerator Center and at the University of Texas. The next generation of RACE studies will be focused on coupling a high-power modulator and klystron to produce 20-30 kW of beam power with existing 20-25 MeV electron linear accelerators. Examination of thermal results at 1.6 kW demonstrates that the Texas RACE target will not withstand the heat produced by a 20 kW beam. This presents a significant challenge for the project, such that a new target design is necessary. CETON was designed to remain within acceptable temperature ranges while still maintaining the neutron production experienced with previous RACE targets.

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**11:00-11:30 a.m.**

**Automotive Black Box**

Department of Electrical and Computer Engineering

Participants: Mark Dayson

Instructor: Dr. Paolo Ginobbi

Faculty Adviser: Dr. Yahia Baghzouz

**Abstract**

The proposed project is to implement a way to obtain raw data in the occurrence of a vehicle accident. General Motors Corp. has installed devices in hundreds of thousands of its cars that collect data when a car crashes much like a black box on an airplane. GM's black box module stores information in the few seconds before a car sensor identifies a crash. The automotive black box/data logger uses its own sensors, measuring acceleration, humidity, temperature, vehicle direction, vehicle tilt, the time, and the date of a crash. What makes this project unique is that instead of storing the last few seconds before a car crash, it stores months of data and information, even through multiple or consecutive crashes. This is all thanks to the SD Flash/Memory card integrated in the proposed black box design. So if we want to track data on an accident that happened a week ago sometime in the afternoon, we simply take the SD card out and obtain our results. Data is saved on the SD card as .txt files, with each text file representing a specific date. When a particular file is opened, information is presented in a table format, for easy reading and viewing.

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11:15-11:45 a.m.

## Eye Tracking Device for Real Time Remote and Vision System

Department of Electrical and Computer Engineering

Participants: Steve Mikhail, Aaron Ponzio, and Tan Wu

Instructor: Dr. Paolo Ginobbi

Faculty Adviser: Dr. Emma Regentova

### Abstract

We designed and built a vision system controlled by the user's eye movement. If the user moves his/her eyes in a certain direction, our system captures and processes the eye motion of the user and transmits the signals to our robotic unit. The robot will then mimic the exact same motion of the users' eyes. The robot captures real time video of what it sees and transmits it back to the user.

For most of the modern remote vision system, the user has to wear some kind of head-mount devices to track head and eye movement. It is cumbersome and is not user-friendly. Our head/eye movement processing system does not require any additional hardware other than a single camera and PC, which then transmits the control signals to the robotic unit. This robotic unit can be mounted on any mobile device so it can be used to explore hazardous areas. It can also be used in surveillance, medical, military combat, and child monitoring systems.

For the software system, we implemented eye tracking and eye gaze detection routines using digital image processing techniques. This includes such subjects as projection functions, neural networks, mean-shift/kalman algorithms, and thresholding techniques. For the hardware system, we used such hardware devices as RF transmitters and receivers, servo motors, CCD cameras, and microchips to implement our design.

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# 11:30-Noon

## Open

Department of

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Faculty Adviser:

## Abstract

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**1:15-1:45 p.m.**

**Open**

Department of

Participants

Instructor:

Faculty Adviser:

**Abstract**

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1:30-2:00 p.m.

## Remote Interface of Appliances

Department of Electrical and Computer Engineering

Participants: Matt Broughton and James P. Burnett

Instructor: Dr. Paolo Ginobbi

Faculty Adviser: Dr. Mei Yang

### Abstract

Our project is a device that will allow a user to determine the current status of an electrical device remotely by phone; the user can choose to switch the device on or off with a simple command. Two pieces of self-contained hardware were designed: a console requiring phone access, and the appliance control. The console detects incoming calls then sends the CID information to a PIC16F877 which then determines whether or not the number is on the user-predefined approval list. If it does, the microcontroller signals the telephone-interface circuitry to answer the call, and user access begins.

Communication to the user from the microcontroller is done through pre-recorded, vocal prompts via the voice chip, and responses are captured from the user in the form of DTMF tones and sent back to the microcontroller. Communication from the console to the appliance control occurs via power line communication using the Intellon P485 and P111. The appliance control's microcontroller transmits the current state of a relay and switches the relay when instructed.

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**1:45-2:15 p.m.**

**2006 Concrete Canoe**

Department of Civil and Environmental Engineering

Participants: Stanley Fong, Marceid Hatcher and Derek Pendergraft

Instructor: Dr. Shashi Nambisan

Faculty Adviser: Dr. Thomas Piechota

**Abstract**

An examination of our canoe's dimensions is presented. The 2006 concrete canoe named Growing Medicine has a length of 22 ft. (6.7 m), a max depth of 13.4 in. (34.04 cm) and a width of 24 in (61 cm). In addition, the thickness of the canoe is 1.5 in. (1.91 cm) and weighs approximately 400 lbs (129.3 kg). Furthermore, the unit weight is 71.48 lb/ft<sup>3</sup> (1145 kg/m<sup>3</sup>) while the compressive strength is 1959 lb/ft<sup>2</sup> (13.4 MPA). Lastly, the color of the canoe is red.

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**2:00-2:30 p.m.**

**UNLV South Parking Garage**

Department of Civil and Environmental Engineering

Participants: Jonathan Seeley and Akash Sehdev

Instructor: Dr. Shashi Nambisan

Faculty Adviser: Dr. Gerald Frederick

**Abstract**

The University of Nevada, Las Vegas (UNLV) is a landlocked campus on 337 acres. The current enrollment of 27,000 students is expected to exceed 35,000 by 2012. A campus master plan (Smith Group JJR, 2004) has been developed which addresses the issue of parking availability, and it calls for five new garages to be constructed. This project provides a complete design of a 2500 stall parking garage on the south end of the campus. The design includes a circulation layout study, geotechnical investigation, and structural design. The design has been performed within the constraints and recommendations of the UNLV campus master plan, and conforms to the standards set forth by Clark County Development Services. Mr. Mike Sauer, Associate Vice-President for Administration at UNLV, will be provided a soils investigation report, structural plans, and structural calculations for the construction of the parking garage.

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2:15-2:45 p.m.

**Open**

Department of Engineering

Participants:

Instructor:

Faculty Adviser:

**Abstract**

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**2:30-3:00 p.m.**

**Next Generation Football Helmet**

Department of Mechanical Engineering

Participants: Jonathan Seeley and Akash Sehdev

Instructor: Dr. Zhiyong Wang

Faculty Advisers: Dr. Robert F. Boehm and Dr. Brenden J. O'Toole

**Abstract**

This football helmet will reduce the chances of the athlete developing heat-related illness while providing impact safety that meets or exceeds current safety standards. Current football helmet design has improved significantly over the past two decades; however most of the designs have applied the same basic principle of utilizing various types of insulative materials, typically polyurethane foams. The current helmets have impractical ventilation design and padding placed in geometric configurations that are restrictive to air flow. Thus, they do not give proper considerations for dealing with the heat-related illnesses that occur from insufficient heat removal from the head. The design focuses on an innovative implementation of solid gels in hexagonal-honeycomb padding structure which helps both in shock absorption and the ability to transfer heat away from the head due to its highly flexible and thermally conductive properties.

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**2:45-3:15 p.m.**

**Open**

Department of

Participants:

Instructor:

Faculty Adviser:

**Abstract**

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3:00-3:30 p.m.

**Open**

Department of

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Faculty Adviser:

**Abstract**

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**3:15-3:45 p.m.**

**Open**

Department of

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Faculty Adviser:

**Abstract**

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3:30-4:00 p.m.

## True POS Restaurant Self-Ordering System

Department of Electrical and Computer Engineering

Participants: William Downer, Jon Ross, and Mike Sadowitz

Instructor: Dr. Paolo Ginobbi

Faculty Adviser: Dr. Rama Venkat

### Abstract

True Point-of-Sale (TruePOS), a system designed to allow customers of food and beverage service establishments to place their own orders, is described. Wait times cause customer frustration while slow turnaround times cause loss of profits. To solve this problem, we designed a complete system that will be used from entry to exit of the establishment. A "table unit" will allow customers to place orders, page wait staff, and pay the bill with a credit or debit card all at their convenience. Voice prompts will signal the customer at appropriate times. A "kitchen unit" will receive all orders and send estimated time of arrival updates to customers. A "server unit" will be paged when orders are ready and when customers request service. These units will communicate wirelessly via Bluetooth v1.1 Class 1 devices with a range of 100 meters.

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**3:45-4:15 p.m.**

## **Ultra GPS-Advanced GPS Logging**

Department of Electrical and Computer Engineering

Participants: Glenn W. Mercier and Ryan Smith

Instructor: Dr. Paolo Ginobbi

Faculty Adviser: Dr. Robert A. Schill, Jr.

### **Abstract**

Our project uses two of the most exciting and rapidly growing technologies available: GPS and solid state flash memory. Our project uses a sophisticated microcontroller and a FAT32 processing chip to merge the two technologies to create an innovative advanced personal logging system.

UltraGPS is a pocket sized fully-integrated stand alone unit and includes major components such as an LCD display, WAAS GPS receiver, SD/MMC flash memory socket, and a high-density Lithium Polymer battery with an on-board integrated charger. UltraGPS outputs data by creating NMEA files, Google Earth KML Files, and an LCD display for instantaneous feedback.

Our efforts produced a product that fulfills many needs such as personal training where one can track exact distance and speed over time. A second use could be automobile tracking to monitor speed, distance and locations visited. This might have future possibilities for implementation with insurance companies. UltraGPS would be of significant benefit to novice boaters who are unfamiliar with navigation but can now match exact location with a map. Other uses include geocaching, which is a worldwide treasure hunt, and general roadside assistance.

With the intuitive user-friendly interface, small physical dimensions, Google Earth compatibility, and the ability to write to multiple files simultaneously, we believe our product has great potential for commercialization.

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