5-2-2007

College of Engineering Senior Design Competition Spring 2007

University of Nevada, Las Vegas

Celebrate the spirit of entrepreneurship...

Spring 2007 Senior Design Competition

The Howard R. Hughes College of Engineering

May 2, 2007

UNLV
UNIVERSITY OF NEVADA LAS VEGAS

Image courtesy of Phoenix International, Inc.

Spring 2007
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:

Dr. Qiong Liu, P.E., P.T.O.E.
Department of Public Works,
City of Las Vegas

Joe Martell
Southwest Gas Corporation

Robert L. Mendenhall
Las Vegas Paving Corporation

Igor Tsapenko
Aldec, Inc.

9:00 - 9:30 a.m.

StoreQuest

Department of: Electrical & Computer Engineering
Project Participants: Ahmed Moustafa and Vincent Veilleux
Instructor: Dr. Paolo Ginobbi

Abstract

This project is designed to solve the problem many customers have, as they go shopping at a big store such that of Wal-Mart. The STOREQUEST consists of a graphical touch LCD screen, which will make the customers visit to the store more efficient and much faster. This screen will help the customer to find the product the are looking for, for example trying to find a can of beans, the customer will have to navigate threw a list of items displayed in an alphabetical order and chooses a can of beans, next the screen will display which aisle and what shelf the item is located. The customer will also have the chance to add items to his shopping list and calculate how much his items came to be before the check out. This device is designed to be carried around the store connecting wirelessly to a computer which contains the store data base, and is also rechargeable. This device will save time for the customer and also give more time to the retail store worker to do his work, instead of helping customers finding their items.

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9:45 – 10:15 a.m.
Residential Development at Allen and Ranch House

Department of Civil & Environmental Engineering
Project Participants: Shaun Boulton, Scott Braddell, Mauricio Cardenas, and Luis Saurez
Instructor: Dr. Walter C. Vodrazka
Faculty Adviser: Tom Barnes
Community Mentor: John Land, Wood Rodgers

Abstract

This project is a residential development located on a five acre lot at the southeast corner of Ranch House Rd. and Allen Lane in the City of North Las Vegas. Twenty single family homes will be built on the site. A tentative site plan was devised and approved by the City of North Las Vegas and utilized to conduct five Preliminary Engineering Studies consisting of:

- The review of drainage studies completed in the site's vicinity.
- The preparation of a rough grading plan including at least two alternative options.
- The revision of outsourced earthwork calculations to compare the design with a retaining wall vs. earth import/export to determine the best design choice
- The preparation of a master utility plan including at least two alternatives.
- The preparation of traffic study to help mitigate the impact of the development on the existing traffic conditions

The final engineering phase will provide for the following products:

- Final lot fit analysis
- Utility analysis
- On-site improvement plans
- Off-site improvement plans
- Final mapping

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10:30 – 11:00 a.m.

Wireless LCD Display

Department of Electrical & Computer Engineering
Project Participants: Joshua Langdon, William Muir, and Ryan Schuller
Instructor: Dr. Paolo Ginobbi
Faculty Adviser: Dr. Paolo Ginobbi

Abstract

Advertisers in retail, hospitality and many other industries are constantly seeking better ways of contacting their clientele. Further more, informational postings throughout public buildings often need to be updated or changed to reflect current conditions. In many cases, the location of these notices need to be mobile in order to reach the largest audience. In addition to providing capability for informational postings and announcements, during emergencies these devices could also be used for warning or evacuation direction. These issues illustrate the need for a portable display system that can be quickly and effectively updated with current information.

To meet this need, we have designed a wireless LCD module capable of displaying a series of wirelessly transmitted images controlled from a central location. This module could be used for advertising in elevators, retail stores, or other locations. The wireless data connection allows the unit to receive and display image files in places inaccessible to normal networking cables. These files are centrally stored and easily changed or updated from a single location. With many other possible applications, we believe this product will greatly enhance the visual communication capabilities across many industries.

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10:45-11:15 a.m.

Automatic Guitar Tuner

Department of: Electrical & Computer Engineering
Project Participants: Zeb Fettig and Jason Strebe
Instructor: Dr. Paolo Ginobbi
Faculty Adviser: Dr. Paolo Ginobbi

Abstract

The automatic tuning of an acoustic guitar is attained by mounting small motors to the keys on the head of the guitar along with a small circuit that is operated with a microprocessor.

The microprocessor measures the frequency of the plucked string and moves the strings accordingly. The design concepts of analog filtering, signal analysis, embedded design, feedback, power management, PCB layout, and practical design are all strained in this circumstance. Care must be given to the inherent hysteresis of the strings and overall weight.

For conceptual demonstration, this project is tuning only one string as it can easily be expanded to all six strings of the guitar for production.

NOTES: _____

11:00 – 11:30 a.m.

The Valley Commercial Center

Department of Civil & Environmental Engineering
Project Participants: Tyson Day, Todd Gardner, Robert Hansen, and Jarah Parke
Instructor: Dr. Walter C. Vodrazka
Faculty Adviser: Dr. Sajjad Ahmad
Community Mentor: Mr. Phillip Wakefield, Alpha Engineering

Abstract

The Valley Commercial Center, a premier 1.2 million square feet commercial development, will be constructed on a 40-acre parcel located at the northwest

corner of Tropicana Avenue and Paradise Road. Our team will provide civil design services to mitigate traffic impacts, perform hydrologic/hydraulic analyses, and provide basic grading services for the commercial center. The development will generate a substantial amount of additional traffic based on project use and trip generation. The existing and anticipated future traffic conditions will be analyzed to determine the impact of the new development and to design suitable traffic mitigation solutions.

In addition, an existing channel west of the property will impact the site with an estimated water flow of 1,057 cfs during a 100-year storm event. A facility to convey flows across the site will be designed to protect the proposed development without negatively impacting downstream developments. Multiple alternatives will be examined including possible onsite storage during the 100-year event. Alternatives for both traffic and drainage will be selected based on a decision matrix. Preliminary improvement plans to be completed for the selected alternatives include a grading plan, a conveyance facility plan and profile, and roadway improvements plans. In addition, a drainage and traffic study will be completed for the development.

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11:15 – 11:45 a.m.

Ultrasonic Navigational Cane for the Visually Impaired

Department of Electrical & Computer Engineering
Project Participants: Dulan Abey, Enri P. Mendoza, and Oscar Solórzano
Instructor: Dr. Paolo Ginobbi
Faculty Adviser: Dr. Venkatesan Muthukumar

Abstract

There are roughly 11.4 million visually impaired people who experience difficulty while visiting various facilities. This inability denies them convenient access to many buildings, impedes use of public transit, and makes integration into local communities difficult. Hence, there is a significant need for assisted navigation systems which help the visually impaired overcome barriers, especially in unfamiliar environments where conventional aids, such as white canes and guide dogs, are of limited use.

With the advancements in the fields of radar and sonar technologies, several companies have developed commercial Electronic Traveling Aids (ETA) that are aimed at improving how the visually impaired go about daily life. The effectiveness of such devices is quite remarkable, but a primary concern is pricing. Our group has decided to improve the typical white cane by integrating a circuit that will detect if an obstacle is within a foot of the user's path, steering them clear via voice instructions. Our Ultrasonic Navigational Cane aims to produce the same effectiveness of ETA's in the market and yet offered at a more economical price point.

NOTES: _____

11:30 a.m. - Noon

Elkhorn Road and Decatur Boulevard Traffic Signal Design

Department of Civil & Environmental Engineering
Project Participants: Joseph Cetrulo, Madalena Choi, and John McAvoy
Instructor: Dr. Walter C. Vodrazka
Faculty Adviser: Dr. Mohamed Kaseko
Community Mentor: Mr. Carlton Urban, City of North Las Vegas DPW

Abstract

The area in the vicinity of the intersection of Elkhorn Road with Decatur Boulevard is experiencing rapid growth in both population and traffic demand. This project introduces the design of a traffic signal at this intersection in an effort to enhance safety and provide a satisfactory level of service in keeping with traffic projections forecasted until 2030. This intersection currently operates under an all-way stop sign control with half-street improvements. Land uses in the area include residential, commercial, and a future master-planed community.

The centerline of Decatur Boulevard serves as a divider between Las Vegas on the west side and North Las Vegas on the east side. In addition, an overhead power line runs along the Decatur Boulevard centerline. The goal of this project is to design a traffic signal using computer modeling in association with full build-out conditions on all approaches. Additional products will include signal coordination with neighboring intersections, assessing environmental impacts, compiling a list of construction materials, and creating a construction schedule.

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1:15 – 1:45 p.m.

Unmanned Ground Vehicle

Department: Electrical & Computer Engineering
Project Participants: Chandra Blackmon, Brandon Johnson, and Christopher Workman
Instructor: Dr. Paolo Ginobbi
Faculty Adviser: Dr. Emma Regentova

Abstract

In the United States, an auto accident occurs every ten seconds. People are working longer which results in tired and sometimes disgruntled drivers. Technological advances now allow people to talk and send text messages on cellular phones while driving which has become a major problem. Furthermore, driving under the influence has been an enduring problem on our roadways. All of these distractions in any combination can lead to drifting vehicles that result in an accident. Unmanned Ground Vehicles (UGV's) will help alleviate these problems.

Military research laboratories have created UGVs; however, these vehicles are extremely heavy, expensive and exceed the needs of the average civilian. The purpose of this project is to successfully produce a lighter and less expensive UGV.

Essentially, the UGV is a refurbished remote control car. It uses infrared sensors to remain in a lane constructed with a white surface and black lines. The UGV also uses other components that will monitor steering and speed. Similar to cruise control, the user is able to start, stop, and control the speed of the car. This UGV is the beginning of the transition from a military concept to a civilian application.

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1:30 – 2:00 p.m.

Doppler Effect Demonstration Device

Department of Electrical & Computer Engineering
Project Participants: Suchetpun(Ann) Apichardpattanasiri
Instructor: Dr. Paolo Ginobbi
Faculty Advisor: Dr. Paolo Ginobbi

Abstract

The Doppler Effect is the change in frequency and wavelength perceived by an observer, which identifies whether a wave source is sound, light, or otherwise. The Doppler Effect Demonstration Device is a tool used by teachers to show how an observer can create a Doppler Effect by their changing position.

The sound frequency that is generated by this device is beyond the range of human hearing for the comparison of the change in frequency. With a higher frequency, only small movements are required to create noticeable change in Doppler Effect whereas, if the frequency is too small, a movement faster than walking speed would be needed to see a noticeable change in the Effect. Therefore, a higher frequency is used.

The device is shown by having a student hold the sound receiver device while moving toward and away from the sound wave generator. Their movements will be translated into a new frequency by the receiver which is then sent via a wireless connection to the display. The original frequency and Doppler frequency are displayed so students can compare the two and visualize how their movements affect the change in frequency.

The Doppler Effect Demonstration Device is specifically designed for implementation in high school classrooms.

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1:45 -2:15 p.m.

S.W.A.T. CONTROLLER

Department of Electrical & Computer Engineering
Project Participants: Dominic Cummings and Darrel Haeberle
Instructor: Dr. Paolo Ginobbi
Faculty Advisor: Dr. Yahia Baghzouz

Abstract

The intention behind the S.W.A.T. Controller design is to make alternative energy more user friendly in our households. The S.W.A.T. Controller converts and distributes electrical energy for a household environment.

Among the alternative power sources compatible with this system are solar panels and small efficient windmills. In the case of loss of power, the controller will automatically change to emergency power and the battery bank. Then the system will switch supplied power to essential items, such as refrigerator, air conditioning, or any other selected items deemed essential by the home owner.

When not on emergency power, the battery bank provides additional power to the house and lowers the energy bill. This device was developed with the hope of contributing to the many solutions needed to solve the economy's growing energy demands.

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2:00 – 2:30 p.m.

Coyote Springs Golf Course Design

Department of Civil & Environmental Engineering
Project Participants: Alexander Kalawe, Lynden Kobayashi, Brent Robinson, and Brian Wasserman
Instructor: Dr. Walter C. Vodrazka
Faculty Adviser: Dr. Moses Karakouzian
Community Mentor: Mr. Layne Weight

Abstract

The Coyote Springs Investment Group, LLC has concerns related to the event of a

100-year storm in the area. It is anticipated that the heavy rains will result in flooding of the Coyote Springs golf course, thus causing extensive damage to the course accompanied by weeks in inoperability and lost revenues. Our team has been retained to design a facility to help prevent the course from flooding and keep post-storm down time to a minimum. The plan is to design a detention basin to effectively retain the storm water but keeping the basin within the vicinity of a single golf hole.

An important design goal of this project is to maintain the aesthetics and attractiveness normally associated with a championship golf course. The golf hole will be located within the detention basin as an island. The elevated tee and green will allow the hole to be undamaged by the increase in water level during the 100-year storm event.

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2:15 – 2:45 p.m.

Wigwam Storm Sewer Project

Department of Civil & Environmental Engineering
Project Participants: Christopher Gonzales, Kevin Graves, Derrick Pace, and Karl Wolff
Instructor: Dr. Walter C. Vodrazka
Faculty Adviser: Dr. Sajjad Ahmad
Community Mentor: Mr. Wessam Daoud, MWH Americas

Abstract

This project concentrates on the design of a storm drain system in the vicinity of the intersection of Jones Boulevard and Wigwam.

The System will convey water from the intersection to a proposed channel located 1300 feet east at the edge of the Union Pacific Railroad right-of-way. An existing 4'x7' Reinforced Concrete Box (RCB) Culvert ends at the intersection. The culvert must be extended to connect with the proposed channel so as to contain and control flowing storm water. The extension will be designed to prevent ponding, flooding, and uncontrolled water flow in the area, thus keeping damage to facilities in the area to a minimum.

The team will determine the water flow from the upstream intersection, perform a hydrology analysis, and complete a design that meets local codes and design standards.

A construction cost estimate will be provided.

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2:30 – 3:00 p.m.

Tile-Grout Cleaner

Department of Mechanical Engineering
Project Participants: Fausto Bale and Ainoa Castaneda
Instructor: Dr. Zhiyong Y. Wang
Faculty Advisor: Dr. Robert Boehm

Abstract

Tile Grout is very porous and always exposed to elements such as dirt and bacteria; therefore, keeping grout clean is always a concern. Many steam grout cleaners on the market today do not perform effectively as claimed by manufacturers. These steam machines sometimes emit hot water, not steam, and leave a wet residue on the surface which requires cleaning. The objective of this project is to design a tile grout cleaner that produces a high temperature & high pressure steam.

The design consists of a single machine that encompasses a steam boiler and vacuum cleaner. The Grout Cleaner is designed to produce a high temperature but low moisture vapor, while remaining portable. In addition to the vacuum cleaner, the user will be able to simultaneously clean tile grout and remove debris. This machine is designed to be effective and efficient in the tile grout steam cleaning method.

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2:45 – 3:15 p.m.

Liquid Synergy

Department of: Mechanical Engineering
Project Participants: Eric D. Parlade
Instructor: Dr. Zhiyong Y. Wang
Faculty Adviser: Dr. Daniel Cook

Abstract

The popularity and demand for water fountains have been increasing tremendously. Since the demand has increased, the need for new ideas and innovative designs has also increased. Designers have good ideas, but are not technically savvy enough to produce them. This project aims to integrate engineering and art to produce innovative water dynamics. The focus of special water dynamics in Liquid Synergy will be the induction of a liquid tornado or vortex. The vortex can be viewed through a 1 foot tall, 3 inch diameter, and clear PVC cylinder, placed in the vertical position. As the liquid inside the cylinder rotates about the vertical axis, the forces due to high rotational speeds will result in the liquid forming a parabolic shape. This parabolic shape will undergo a variation of pressures in all directions which will result in the appearance of a beautiful dancing liquid tornado.

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3:00 – 3:30 p.m.

Civil America: Park Trails Estates

Department of Civil & Environmental Engineering
Project Participants: Ferrin Affleck, Nesley Orochena, Douglas Terrill, and Tahmineh Zenhari
Instructor: Dr. Walter C. Vodrazka
Faculty Adviser: Dr. Thomas Piechota
Community Mentor: Lynn H. Affleck, P.E.

Abstract

Park Trails Estates is a 14.47 acre residential development located in Clark County, Nevada in the northwest portion of the Las Vegas Valley near Lone Mountain. This site will be developed for 24 single-family lots all approximately 20,000 square feet. The Assessor's Parcel Numbers for this site are 138-05-613-001 through 024.

Lynn H. Affleck, PE at Affleck Engineering provided a Clark County approved tentative map with site layout and existing topography. Affleck Engineering retained Civil America for civil engineering services. These services include a design plan set, drainage study, and final design report. The design plans will be generated using AutoCAD software. The drainage study calculations will be performed using Clark County Regional Flood Control District's Drainage Design Management System (CCRFCD DDMS).

The purpose of this project is to provide a cost effective design for the development of this parcel. This project will display teamwork in problem solving and design. Major concepts applied in this project are Hydrology, Hydraulics and Land Development.

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3:15 – 3:45 a.m.

Laptop Cooling Station

Department of Mechanical Engineering
Project Participants: Rocío Hernandez, William Nelson, and Russell Robinson
Instructor: Dr. Zhiyong Y. Wang
Faculty Adviser: Dr. Daniel P. Cook

Abstract

Mac's PowerBook computers have had chronic overheating problems since their introduction, sometimes reaching surface temperatures as high as 130 °F. As with most electronic devices increased operating temperatures can have a direct impact on the lifespan and operation of laptop computer components. In addition to these technical problems, increased temperatures can cause discomfort or injury to the user. Given the multitude of problems associated with high laptop computer temperatures, there is a definite need for a functional and aesthetically pleasing laptop cooling device tailored to the Mac PowerBook market. Specifically, a design which reduces CPU temperature by 5°F and maintains the bottom laptop surface at a temperature below 105°F would alleviate both the technical and ergonomic problems associated with laptop overheating.

The final design for the Laptop Cooling Station consists of an aluminum base plate and fin array hinged to an aluminum case with an extendable mouse tray. This design produces excellent heat dissipation while maintaining light weight, silent operation, reasonable durability, and an aesthetic style similar to the Mac PowerBook laptop, our target market. Incorporation of ergonomic considerations as well as thermal and mechanical analysis created a finished product that is comfortable, effective, and easy to operate.

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3:45 – 4:15 p.m.

Sienna Gardens Office Building

Department of Civil & Environmental Engineering
Project Participants: Jessica Leavitt, Jacelyn Rice, and Ramona Sanders
Instructor: Dr. Walter C. Vodrazka
Faculty Adviser: Dr. Samaan Ladkany
Community Mentor: Mr. Benjamin Rogers, Wright Engineers

Abstract

Sienna Gardens Office Building is a 14,500 square foot building to be located near the intersection of Town Center and I-215 in Las Vegas, Nevada. The two-story building is a wood framed structure designed according to the International Building Code 2003.

The design encompasses a gravity analysis, a lateral analysis of wind and seismic forces, as well as the foundation design. The project also includes structural drawings for the foundation and framing plans, in addition to detail sheets.

A design matrix has been generated for comparison of the selected design and alternate designs. The overall goal is to demonstrate that the final design is structurally sound for its intended commercial use.

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Schedule of Senior Design Project Presentations
Thomas Beam Engineering Complex, Great Hall
May 2, 2007

NOTES:

The Howard R. Hughes College of Engineering applauds your efforts!

We look forward to our annual Senior Design Dinner Friday, May 4, 2007 at the Cox Pavilion


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