Senior Design Day
April 24, 2015
UNT Discovery Park
The new Rawlins dormitory will be a state of the art facility focused on housing freshmen from the Honors College. This building will allow the UNT Housing and Residential Life Department to offer a range of room sizes and public space options for the Honors College. Rawlins dormitory will be an 118,332 square foot 5-story building consisting of 250 student bedrooms with natural lighting throughout its entirety. Rawlins hall will house an estimated 500 students that will live in a close-knit, scholarly community in close proximity to most main locations on campus. Rawlins Hall’s location allows it to be the centerpiece in the planned Gateway Walk that connects Apogee Stadium, the new bridge, and the Gateway Center to the rest of the campus. The design of the building, with closely spaced smaller bedrooms and common rooms at the ends of the halls as well as study areas will foster a scholarly atmosphere and allow the honors freshmen to thrive in the new college environment. Additional project scope will encompass site renovations and a courtyard near the south of the building to allow students to take a break from their studies, exercise, enjoy the outdoors, as well as travel through a beautiful and safe environment to other areas of campus.
Team Name: Mean Green Bridge & Road  
Sponsor: Aaron Barry with Mario Sinacola & Sons  
Program/Department: UNT Construction Engineering Technology

Team Members:  
Catherine Dickson  
Nicolas Espinoza  
Lee Pelton  
Robert Pleasants

Historically, a heavy highway civil construction contractor would complete the job within the allowed schedule and under budget to turn a profit, without much concern for impacts to the environment or building a sustainable road. Therefore, our senior design team has addressed society’s movement to “going green” by transforming an existing heavy civil project in the City of Frisco to a “green” project. Our group modified certain methods of the construction process through value engineering research, verifying that most materials are recycled, and ensuring that there is a significantly less impact on the environment during the entire construction process. Our team used BIM coordination and clash detection to find potential delays in the schedule and establish clear right-of-way for our subcontractors to conduct their installations. Implementing these alternative solutions has created a unique challenge to complete this project within the proposed schedule and budget. As society moves toward making the environment a priority, our team is looking forward to reducing our carbon footprint for the benefit of future generations by redefining how heavy civil roadways are constructed. Our UNT senior design group has accomplished this through the project of Rockhill Parkway in Frisco, Texas.
Team Name: Lonestar Construction  
Sponsor: TX Morrow Construction, Inc.  
Program/Department: Construction Engineering Technology

Team Members:  
Whitney Eaton  
Hossein Heidari  
Kevin Holden

Lone Star Construction is proud to present to you the beautiful new apartment complex in McKinney, Texas -- the Venue at Craig Ranch. The Venue at Craig Ranch is a proposed 7 building apartment complex that will continue to enhance the community of McKinney Texas. This development will provide affordable living for people who either are looking to downsize or to eventually become homebuyers. Our apartment complex will provide beautiful surroundings as well as efficient living. We will provide a high standard of living for only $800-$1800 a month. Through this 16-month long project, we will be providing homes for over 270 different families in various demographics. Our 16 different floor plans provide for versatility to appeal to each family's needs.

As the city of McKinney grows, the Venues at Craig ranch will help to mitigate the need for places to live. After conducting the research and determining the cost to develop, build and sell on this site, Lone Star Construction views this apartment complex as a wonderful opportunity to continue to add beauty and affordability to the McKinney area.

Electrical Engineering Technology

Team Name: Arduino High-Definition Radio  
Program/Department: Engineering Technology

Team Members:  
Maxwell Carritt  
Philip Chandler  
David Powers

This project aims to design and prototype a stand-alone High Definition (HD) FM radio. It is based off of an existing design that utilizes an Arduino Uno to control the functions of the radio, and outputs the audio through headphones. (Craig A. Lindley, Nuts & Volts, February 2014, Page 38-45). In this project, the standard FM receiver is replaced with an HD receiver capable of FM, AM, and HD FM. The audio output will also be changed to a speaker driven by a compact tube amplifier. The code being ran by the Arduino Uno will be modified to utilize a function of the new receiver known as Radio Data System (RDS). This will take data embedded within the FM signal and output the information to the LCD screen. The code will also be modified to implement any new seeking or scanning functions that the new receiver contains.
**Team Name:** Retro Frequency Counter  
**Program/Department:** Engineering Technology

**Team Members:**  
Jessica Clary  
Broderick Parks

This project aims to design, retrofit and prototype a frequency counter. The original design operates by using a single logic chip frequency counter and minimal circuitry. The frequency counter designed in this project takes elements from the original design and improves upon them. The redesigned frequency counter will perform as a stand-alone universal counter using the capabilities of the ‘B’ version of the logic chips. Instead of only measuring frequency, it will function as a period counter, frequency ratio counter, time interval counter and totalizing counter. The design branches away from LED display and is upgraded to support an LCD configuration via an Arduino microcontroller. The original design has a resolution of up to 150 MHz while the improved design will have a targeted resolution of 10 MHz. The design will be powered with an internal power supply making it able to function ‘stand-alone’. The design will be etched to a PCB and placed in an enclosure.

**Team Name:** Real-Time FPGA Audio Effects Generator  
**Program/Department:** Engineering Technology

**Team Members:**  
Andrew Harrison  
Lenge Fiston  
Ronald Paul

Audio sampling and effects are used in numerous applications that involve audio editing. Audio editing is used in music, sound effects, and in speech for movies, television, video games, voice recognition etc. This project will use an FPGA to demonstrate how real-time audio editing and effects can be performed by taking a voice recording which will be sampled and altered to give the desired effect. The platform chosen for this demonstration is the Altera DE2 board equipped with an onboard Cyclone IV Field Programmable Gate Array (FPGA). Mixed-language (VHDL, NIOS II assembly and embedded C) will be used to create a soft processor in the FPGA fabric and program all required interface elements.
Team Name: High-Data Rate, Low-Power Wireless Sensor Network for Structural Health Monitoring
Sponsor: National Science Foundation grant #1244129
Program/Department: Engineering Technology

Team Members:
Luis Flores
Ryan Hagood
David Shawn Kennedy

This project is a continuation of the research and prototype design of a wireless sensor node network (WSN) for monitoring structural health. An NSF grant, titled “A New Interdisciplinary Technology Education Strategy Using State of the art Wireless Sensor Network”, funds the project. The WSN, known as a structural integrity monitoring system (SIMS), transmits critical structure data through a series of nodes to a common base station for data acquisition. The data includes acceleration taken from accelerometers along with a very accurate time stamp via a temperature controlled real time clock (RTC). For the transmission of the data, SIMS uses the industry standard ZigBee protocol, to create a wireless mesh network. This mesh networking is crucial so all of the nodes are capable to talk to one other and transmit the other’s data if the node is out of range. To bring all of these instruments together as to create a node or a base station, a microcontroller is utilized to coordinate the data collection and transmission. Applications include but are not limited to bridge load analysis, building movement testing (high winds or heavy traffic) and post-earthquake monitoring.
Mechanical Engineering Technology

Team Name: FSAE Chassis Team

Program/Department: MEET/Engineering Technology

Team Members:
Matthew Hatton
Cedric Mbazoloumoue
Kellen Myers
Cody Wages
Tyler Zepp

The Formula SAE (FSAE) Chassis team is part of the University of North Texas’ Society of Automotive Engineers (SAE) organization. The team was in charge of designing and building components for the 2015 Formula racecar including: chassis, differential mounts, engine mounts and ergonomics (gas/brake pedal assembly, firewall, floor, and seat). Due to the fact that the Chassis team is the only Engineering Technology (ETEC) team, the team was also tasked with building any other components needed for the car that required using of ETEC shop equipment. Some of these components included bearing housings, frame slugs, tire rods, pull rods, etc… The goal for this year’s team was to improve upon 2014 Formula SAE racecar design in areas of weight reduction, driver comfort, and overall style. A full-scale model of the chassis and its components were designed and tested in Solidworks computer-aided design (CAD) software. In addition to the virtual simulations, the racecar was physical tested and inspected to ensure all rules and regulations were met with the ability to withstand the stresses placed on the car during competition.

Team: 2
Program/Department: MEET Engineering Technology

Team Members:
Abram Galindo
Juan Gonzalez
Ricardo Gonzalez
Komi Nyonyotsi

The American Society for Mechanical Engineers (ASME) annually holds national competitions for engineering teams. One of these annual competitions is the Human Powered Vehicle Challenge (HPVC) which tasks teams to build a light-weight vehicle that can be human powered, typically in the form of a bicycle variant. This project is a variant of a tricycle design in that it is a recumbent tricycle with a “tadpole” configuration (two wheels in the front, one wheel in the back) that will be considered for competition as well as recreational use. To achieve this goal, the frame will utilize carbon fiber technology and standard bicycle components for ease of manufacturing. Shimano 105, 11 speed road group drive set to offer smooth and progressive shifting between gears, a Rollover Protective System (RPS) that can be removable and replaced with an adjustable seat mesh for ergonomics and comfort, rear suspension strong enough to handle most road conditions, and finally Ackermann Steering which will allow for a smooth ride.
Our project was to design and build an earthquake simulation shake table. A shake table is primarily used to test structural models or building components to examine their seismic performance. Analyzing the seismic performance is important to ensure the building will be safe should an earthquake occur. Our earthquake simulation shake table will be used for research and for demonstrations to show the effects of an earthquake on scaled building models. Our shake table will allow students to generate data that would be difficult to obtain without a simulation.

While there are currently earthquake simulation shake tables in use, we have developed a design that reduces friction on the table. The reduction of friction allows a 20 GPM hydraulic pump to be used to shake the table while still obtaining a force that accurately simulates an earthquake. The friction reduction in our design is due to the use of cables for suspension of the table. Our shake table will also be convenient for use due to the ease of disassembly for transportation and storage.

The purpose of the Paddle powered wheel chair is to provide operating relief for wheelchair users. The targeted audience for the product are wheelchair users with minimal hand strength such as carpel tunnel. This lever system acts as an extension to the arm; it allows for easy gripping, braking and maneuverability. The natural motion of the push paddle lever is similar to rowing a boat (having an inward and down motion).

The team developed the friction ratchet mechanism and push rim attachment. One feature of the design is the weighted bottom which prevents the lever from moving when the friction ratchet mechanism is not engaged. The use of clamps and springs on the push rim attachment allows for an efficient and reliable insulation option.

Mobility is an essential component of an individual’s quality of life. This push paddle wheelchair project has the potential of improving the daily routine of people with a variety of mobility impairments. The product provides increased performance, low costs, minimal maintenance and reliability for the consumer. The push paddle wheelchair project’s easy grip push rowing motion could be the relief many wheelchair users need to gain their independence back.