ECE is accepting projects for
Fall 2011 Senior Design Show.

ME is accepting projects for
Fall 2011 Senior Design Show.

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Department of Electrical and Computer Engineering (ECE)
Department of Mechanical Engineering (ME)

2011 Spring
Senior Design Show

Tuesday, May 3
2-4:30 p.m.
Coffman Union, Great Hall

COLLEGE OF
Science & Engineering
UNIVERSITY OF MINNESOTA

2011 Spring Senior Design Program

Senior Design is a 4-credit, semester-long course for students in their senior year, with the main objective of providing students with a real-world, team-based design experience through which they develop an appreciation of design methodology and team dynamics, along with refining their oral and written communications skills. Each team of 4-6 students participates in solving an open-ended design problem starting from developing well-defined project requirements/specifications and concluding with a functioning prototype. Projects originate both from industry and faculty sponsors, often require an inter-disciplinary effort, and typically have multiple paths for solution and implementation entailing trade-offs between performance, cost, and manufacturability.

2011 Spring Senior Design Participants

Department of Electrical and Computer Engineering (ECE)

ECE Project: Water and Light Display
Advisor(s): Prof. Kia Bazargan
Students: Peter Awker, Princewell Aneh, Michael Farrell, Lloyd Hilsgen, Kevin Lammi
Description: A Field Programmable Gate Array (FPGA) controlled water display capable of displaying static and dynamic text and images using water-bit-streams with integrated high-powered RGB LED pixel enhancement and lateral image projection.

ECE Project: Smart Solar Tracker
Advisor(s): Prof. Phil Cohen
Students: Jesse Geske, Phillip Hoffman, Dongwon Lee, Tanvi Sikka, Faez Yahya
Description: The Smart Solar Tracker is an embedded system approach to tracking the sun in varying solar conditions.

ECE Project: Photo Voltaic Clothing
Advisor(s): Prof. Rhonda Franklin and Alex Detrick, Minnesota Renewables Energy Society (MRES)
Students: Akmal Arifin, Shan Seong Gan, Benjamin Lewiski, Yvonne Li, Karla Simonson
Description: The design of a main board controller for use in solar cell embedded clothing used to power LED lights, motors, and charge electronic devices.

ECE Project: Ambulatory Blood Pressure Monitor
Advisor(s): Prof. Georgios Giannakis and Larry Beaty, IEEE Phoenix Project
Students: Derek Berger, Shreya Goenka, Negin Mokhtari, Kangyu Qiu
Description: The student members of this project are developing a feasibility concept system for a blood pressure monitor that monitors blood pressure (BP), based on the pulse transit time (a.k.a. pulse wave velocity) concept.

ECE Project: MinnSpec for the Minnesota RockSat Project
Advisor(s): Prof. Ted Higman
Students: Cole Anderson, Shishuo Ding, Joshua Flugaur, Carl Johnson, Patrick Plonski
Description: An ozone photospectrometer and power supply for use in a rocket.

ECE Project: Re-thinking Surveillance
Advisor(s): Prof. Nikolas Papanikolopoulos, Computer Science and Engineering, Prof. Diane Willow, Art Department, Prof. Tasoulla Hadjiyanni, Department of Design, Housing and Apparel
Students: Ryan Bloss, Taylor Lotsgaarden, Adam Mateen, Joseph Oyer, John Zimmer
Description: Rethinking surveillance is about producing an integrated surveillance system that encourages interaction with the users it protects while using technology to improve the way surveillance secures a location.

ECE Project: Smart Electric Outlet
Advisor(s): Prof. Tom Posbergh and Brandon Tackaberry (Tackaberry Electronics)
Students: Fuhua Ding, David Scheler, Andrew Sowada, Jason Poppler
Description: The Smart Outlet System is a safe permanent energy efficiency product for all residential and office automation.

ECE Project: Bioluminescence Art Display
Advisor(s): Prof. Marc Riedel and Prof. Diane Willow, Art Department
Students: Christian Fenstermacher, Jason Jaquess, Yijun Lin, Kripa Shanbhag, Allen Snider
Description: The Bioluminescence Project consists of the development and fabrication of an electromechanical control system that translates the quantity and movement of people into a nocturnal bioluminescent visual display.

ECE Project: ThermoElectric Generator Powered Circuit Cooler
Advisor(s): Prof. William Robbins and Bernadine Splettstoeszer, Benchmark Electronics
Students: Kondiway Bagana, Mohammad Irfan, Matthew Jester, Hunter Moen, Anthony Silbernagel
Description: Our project is the development of a proof of concept for thermally-powered microprocessor cooling system.

ECE Project: Safe Navigation for Visually-Impaired People: Automatic Detection of Steps and Stairs
Advisor(s): Prof. Stergios Roumeliotis, Computer Science and Engineering
Students: Murid Amini, Sherief Elabbady, Nathan Peters, Mathew Ryden, Onuoha Iroro
Description: Using Computer Vision Technologies and the Swiss Ranger 3000 Camera for Automatic Detection of Stairs to Assist in Safe Navigation for Visually Impaired people.

ECE Project: MegaBrite 3000 Solar Lantern

Advisor(s): Prof. Paul Ruden and Patrick Delaney, Valu Lamp, Inc.
Students: Tarig Banaga, Daniel Bird, Andrew Grabow, Martin Ivanca Drouillard, Kenton Pagel
Description: MegaBrite 3000 is a handheld, solar-charged LED lantern designed to help illuminate the developing world.

ECE Project: Northern Sparks Art Display

Advisor(s): Prof. Sachin Sapatnekar and Prof. Ali Momeni, Art Department
Students: Eric Bangen, Luke Buer, Daniel Hagaman, Anton Zuponcic, Heng Zhang
Description: This design aims to improve modern electronic art by allowing wireless control of devices used in displays or shows.

ECE Project: FPGA Implementation of an ECG-based Attention Monitoring System

Advisor(s): Prof. Gerald Sobelman
Students: Kiel Brezina, John Hermanson, Lin Junxiang, Ahmed Soliman
Description: An FPGA-based, 16-feature extraction from ECG signal for use in an attention monitoring system.

ECE Project: K9 Timer

Advisor(s): Prof. Joey Talghader
Students: Daniel Heim, Jeffrey Hillyer, Ernie Kim, August Lentsch
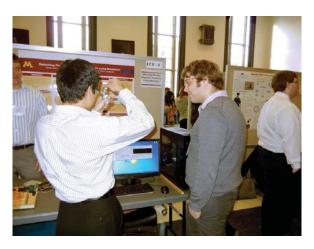Description: The K9 timer is a rugged, long-distance sensing system that will be used in the Woodbury Police Department's K9 certification and training.

ECE Project: Magnetic Detection of Football Location

Advisor(s): Prof. Randall Victora
Students: Biruk Asfaw, Jason Hendrix, Dereje Kebede, Scott Rengel, Shirpal Jain
Description: A magnetic sensor system for detecting the time and orientation at which a football crosses the goal line.

2011 Spring Senior Design Participants

Department of Mechanical Engineering (ME)

ME Project: Bi-modal Ankle Foot Prosthesis (Ankle)

Advisors: Andrew Hansen (Minneapolis VA Medical Center)
Students: Daniel Castle, James Dawson, Garrett Lahr, Matt Sass, Nathan Smith
Description: Design and build a prosthetic ankle-foot system which is equally effective meeting the requirements for walking and standing activities.

ME Project: Equipment Heat Exchanger Cleaning Device (Cleaner)

Advisors: Dave Hennessy (Horton, Inc.)
Students: Michael Campbell, Jamil Orfali, Stephen Stone, Jacob VandeHei, Kevin Watson
Description: Design a more cost efficient means to remove debris from a heat exchange used in agricultural and construction equipment.

ME Project: Cold Compression Orthotic Device (Compression)

Advisors: Dawn Bardot & Michael Dahl (Medical Device Center Innovation Fellows)
Students: Jacob Goetz, Matthew Herlofsky, Nick O'Shea, Gentry Talbert, Kelsey Yoch
Description: To investigate, design, build, and evaluate a combined cooling, cyclical compression splint for the lower leg.

ME Project: Infeed Conveyor Design (Conveyor)

Project Advisors: Matt Toyli & Nick Velander (Douglas Machine)
Students: Seth Detjens, Brett Hillukka, Christopher Huxtable, Zaky Mohammad, Lucas Wysocki
Description: Improving the performance of random timing infeeds used in case packing by focusing on improving belt tracking, belt cleanliness, and ease of maintenance of the conveyors in use.

ME Project: Tow-Behind Sliding Weight Dragsled (Dragsled)
Advisors: Jeff Stern (Caterpillar Paving Products, Inc.)
Students: Joe Finch, Steve Haas, Ben Lacefield, Quentin Mege, Nathan O'Connor
Description: Design an apparatus, which has variable load capability, to be pulled behind heavy machinery to assess the cooling capability of the engine while under a full load.

ME Project: System Efficiency – Radiant vs Forced Air (Efficiency)
Advisors: Mark Hudoba & Aaron Stotko (Uponor NA, Inc.)
Students: Bryan Correll, William Jaffray, Jason McConnell, Roger Morrison, Stephen Ricard
Description: Analyze hydronic radiant system efficiency versus a typical HVAC system for residential applications.

ME Project: Cold Engine Start Testing Apparatus (Engine)
Advisors: David Bennett (Mechanical Engineering, University of Minnesota)
Students: Andrew Bean, Kyle Hoen, Adam Krzmarzick, Ed Novak, Nathan Wilson
Description: Design and build a portable engine stand to test cold engine starts.

ME Project Envelope Machine (Envelope)
Advisors: Dick Comben (Spear Envelope and Wood River Technology)
Students: Norfazren Adnan, Hariz Anwarul Halim, Dustin Bowman, Jitae Do, Thomas Wieselmann
Description: Design and evaluate envelope machine (used to assemble envelopes) ideas and concepts to improve output performance and reliability.

ME Project: Local Produce Storage Building (Produce)
Advisors: Paul Hannemann & John Hatzung (Fresharc)
Students: Charlie Brault, Jacob Fischer, Tobias Harrison-Noonan, Andrew Logerquist, Robert Westcott
Description: Design a storage building that can cool and store a range of produce products at optimal conditions.

ME Project: Evaluation of Fluidic Sensor – Socket Interface (Sensor)
Advisors: Mark Tondra (Diagnostic Biosensors, LLC)
Students: Douglas Carlson, Andrew Healy, Jalal Rana, Zhen Sun
Description: Improve the manufacturing process of biosensor test fixtures based on the design from Fall 2010 and then evaluate the performance of the socket/sensor interface.

ME Project: Arm Assist Rehab Machine (AARM)
Advisors: Murali Krishnamurthy, Lars Oddsson & Matthew White (Sister Kenny Research Center)
Students: Jenna Bodie, Michael Lind, Faiz Zaid
Description: To design and build an upper extremity rehabilitation device that has variable resistance capacity.

ME Project: Response Spectrum Analysis (Spectrum)
Advisors: Mike Levy & Nam Ngo (BAE Systems)
Students: Evan Kearney, Zalikha Khalid, Samuel Legan, Daniel Nigon, Amy Schellinger
Description: Improving on the design from Fall 2010, that allows experimental analysis of the response spectrum of a given base input.

ME Project: Adjustable Splint/Cast System (Splint)
Advisors: Dick Comben (Wood River Technology)
Students: Steven Geiselman, Andy Heng, Mike Radke, Elizabeth Sefkow, Stephanie Zastrow
Description: Design and evaluate the feasibility of a splint/cast system that uses pneumatic vacuum structures to produce a cast which either can be flexible or rigid.

ME Project: ¼ Scale Tractor Design (Tractor)
Advisors: Jonathan Chaplin (Mechanical Engineering, University of Minnesota)
Students: Katherine Black, Matthew Eisenmenger, Todd Grave, Adam Heimer, Luke Zupan
Description: Design a left-assist system to be implement on agricultural equipment for elderly or disabled persons to help them into the tractor cabin.

ME Project: W.A.D.D.L.E (Waddle)
Advisors: Gwen Fischer & Kryo Miyasaka (Medical Device Center Innovation Fellows)
Students: Colin Boucher, Muhammad Mazlan, Lisa Rizzardi, Nicholas Smith
Description: Design a method (and build a working prototype) to quickly and accurately compute and administer the correct dosage of drugs to pediatric patients.

ME Project: Mobile Manual Standing Wheelchair (Wheelchair)
Advisors: William Durfee (Mechanical Engineering, University of Minnesota), Gary Goldish & Andrew Hansen (Minneapolis VA Medical Center)
Students: Nathan Dehne, Jared Drewa, Jessica Gilbertson, Jeremiah Kornder, Matt Odden
Description: To design and build a working prototype of a mobile standing wheelchair that can switch easily between standing and sitting positions.

ME Project: Flow Divider (Flow)
Advisors: Matt Servatius & Scott Svensson (Tennant Company)
Students: Ashley Botts, Thet Ko, Mohamad Mahyudin, Nur Hidayah Mohd Zamani, Brian Rappl
Description: Design a flow-dividing device that will take in water or cleaning solution at a low flow rate and distribute it evenly to two outlet points.

ME Project: Fluid Power Ankle Orthosis Exhibit (Fluid)

Advisors: Will Durfee & J. Newlin (Science Museum of Minnesota)

Students: Benjamin Brandon, Roman Chebykin, Kevin Geppert, David Hong, Laura McDonald

Description: Develop an interactive exhibit for the Science Museum's exhibit floor that shows how a fluid power orthosis can be used to assist people who have diminished ankle function.

ME Project: Noise Canceling Headband for Sleeping (Hushband)

Advisors: Robert Connor (Medibotics LLC)

Students: David Burdge, Anne Magnuson, Sophie Scheller, Pratik Shah

Description: Design and build a working prototype which comfortably fits around a person's head and actively cancels out ambient noise by means of sounds emitted from sound-conducting tubes with holes built into the garment.

ME Project: Motion Recognition Clothing (Motion)

Advisors: Robert Connor (Medibotics LLC)

Students: Jedidiah Behymer, Matthew Hardyman, Garrison Hommer, Gustavo Lopez, Tyler Olson

Description: Further the advances from last semester's project of tracking human movement through tube sensors built into a suit by improving the accuracy, range, and placement of the sensors.

ME Project: Smart Grid Electric Management System (Outlet)

Advisors: Don Debelak, Jesse Gamble & Brandon Tackaberry (Tackaberry Electronics)

Students: Nathaniel Hansen, Mary Lee, August Marshall, Syairah Mat Isa, Steve Meinhardt

Description: Upgrade the existing design from last semester of a "smart" (can track and report energy usage as well as swivel to reduce tension in electrical cords) household electric outlet.

ME Project: Power Painter Noise Reduction (Painter)

Advisors: Joe Kieffer (Wagner Spray Tech)

Students: Richard Buckner, Matthew Hassler, Nathan Kochie, Siti Salmah Mohd Zain, Juan Panama

Description: Develop low-cost alternative to reduce the noise level of the motor in a spray painter while still meeting the spray performance and maximum allowable heat rise.

ME Project: Palletizer Dispensing Machine (Pallets)

Advisors: Tony Busiahn & Pat Geraghty (Cannon Equipment)

Students: Jesse Behnke, Kristin Haag, Samuel Johnson, Michael Koester

Description: Design an automated palletizer which consolidates two existing devices that have different loading methods into one device that can be loaded either way.

ME Project: Variable Pitch Concept Development (Pitch)

Advisors: Matt Toyli & Nick Velander (Douglas Machine)

Students: Jay Beversdorf, Mark Frick, Aaron Horn, Isaac Neitzell, Rob Cayton

Description: Design, build, and test a new concept for automatically varying the pitch of devices within a packaging machine so that it can be used for more than one product without manual manipulation.

2011 Senior Honors Participants

The year-long Senior Honors Project, carried out during a two-semester sequence, serves as a capstone research and design experience as an alternative to the one-semester group senior design project. Students become familiar with formulating and conducting experiments, applying knowledge, and appreciating the multi-disciplinary and team-based approaches to solving technical problems and developing new engineering techniques and technologies.

Department of Electrical and Computer Engineering (ECE)

ECE Poster: All Digital Phase Lock Loop (ADPLL)

Advisor: Prof. Ramesh Harjani

Student: Brian Wayne Andren

Description: This project is concerned with the analysis and design of a phase lock loop operating entirely in the digital domain.

ECE Poster: Templated Nanoparticle Etching of Graphene for Field-Effect Transistors

Advisor: Prof. Steve Koester

Student: Yoska Anugrah

Description: Nickel nanoparticles are investigated to crystallographically etch ultrasmooth graphene nanoribbons, and a transistor process flow has been developed to utilize this nanoparticle etching in a realistic transistor design.

ECE Poster: Multilayer Loaded Dielectric Metamaterials

Advisor: Prof. Anand Gopinath

Student: Andrew Kyle Brown

Description: Investigation of multilayer loaded dielectric metamaterials for increasing bandwidth.

ECE Poster: Resonant Response of an Adhered Microcantilever

Advisor: Prof. Joseph Talghader

Student: Steven H. Chang

Description: This project analyzes the effect of stiction on the resonant response of a microcantilever.

ECE Poster: The Physical Implementation of Cyclic Combinational Circuits
Advisor: Prof. Marc Riedel
Student: Philip Nathan Greenberg
Description: We proved the validity of cyclic combinational circuits by implementing and testing them on an Field Programmable Gate Array (FPGA.)

ECE Poster: Interior Robot Guide
Advisor: Prof. Volkan Isler, Computer Science and Engineering
Student: Nicholas Daven Kariniemi
Description: The project develops software for a robot guide to interior destinations based on a pre-made map, odometry readings, and a laser range finder.

ECE Poster: Ultraviolet spectroscopy system for measuring atmospheric ozone
Advisor: Prof. Ted Higman
Student: Rebecca Joyce Lam
Description: This project covers the photodetector and data logging systems used for measuring the concentration of atmospheric ozone during a suborbital space flight.

ECE Poster: GPU Application in Stochastic Computation
Advisor: Prof. David J. Lilja
Student: Chen Li
Description: Speed up stochastic computation by introducing GPU parallel programming into regular stochastic algorithms.

ECE Poster: Robust Algorithms for Principal Component Analysis
Advisor: Prof. Georgios Giannakis
Student: Dingyi Li
Description: Study Principal Component Analysis (PCA) both with and without statistical outliers, implement algorithms that have been proposed for making PCAs more robust, and assess their performance for synthetic and real-world datasets.

ECE Poster: Testing the Limits of Magnetic Recording on Conventional Media
Advisor: Prof. Randall Victora
Student: Kate E. Momsen
Description: This research project used computer simulations to explore the possibility of achieving 10 terabits per square inch on conventional media for hard disk drives using the method of Two Dimensional Magnetic Recording (TDMR).

ECE Poster: Development of a Matlab toolbox for distributed control design
Advisor: Prof. Mihailo Jovanovic
Student: Brett Alan Paulsen
Description: This Matlab toolbox solves distributed control problems using various optimization methods.

ECE Poster: Circuit-Level Techniques for Generating Stochastic Bit Streams with ΣΔ Encoders
Advisor: Prof. Marc Riedel
Student: Caitlin Marie Race
Description: We are investigating the quality of the randomness of the bit streams generated by sigma-delta modulators to see if they can be effectively used in digital logic applications.

ECE Poster: Simultaneous Localization and Mapping using a RGB+Range Sensor
Advisor: Prof. Nikolaos Papanikolopoulos CS
Student: Ting Hui Zhou
Description: This work presents a complete solution to the problem of simultaneous localization and mapping using a Microsoft Kinect sensor, which is capable of providing three-dimensional information of the environment.

Thank you for attending the 2011 Spring Senior Design Show.