Senior Design I - Fall 2012

• EECE 401

- CRN 83550
- 3 credit hours
- $\text{ W } 1310 1600 \rightarrow \rightarrow \rightarrow [\text{W } 1410 1700]$
- LKD 1002 → (Later 3121)

• Instructor

- Dr. Charles Kim
- (202)806-4821
- ckim@howard.edu
- Office Hours (LKD3014)
 - M 1300 1500
 - T 1300 1500

Highly recommended course to take along

- EECE416 Microcomputer
- Web ----Syllabus, Notes, etc
 - www.mwftr.com

Intel Sponsored Course (2012-2013 school year)

- 10 Intel Atom boards for implementation of the projects
- Partial Support of Supply and parts for the projects

Senior Design – brief definition

- Is
 - Culmination of EE/CpE Education, Training, etc
 - Design experiences that require adequate consideration of
 - Knowledge
 - standards, and
 - constraints
 - related to the **electrical/computer engineering discipline**.
 - Process to final product (through Senior Design II)
- Is NOT
 - Further expansion of a class project
 - Final product only

Course Objectives and Outcomes

• Objectives

- Learn and use design process to meet needs
- Becoming to be aware of Technology Impact to Society
- Becoming an effective team member
- Becoming an effective communicator
- Enjoy Design Experiences

• Topics of the course

- Engineering Design Processes
- Teamwork
- Communication
- Professional (or "soft") Skills
- Industry Experts and Guest Speakers

Course Outcomes (ABET)

- (c) Design a system component, process, or system
 - Throughout the class, we learn the design process and apply it and integrate to a working system which solves customers' problem
- (g) Effective communicator -
 - Presentations and report writing will enhance verbal, written, and slide communication
- (i) a recognition of the need for, and an ability to engage in life-long learning
 - Awareness of the continued, non-stop learning of new technology
- (j) a knowledge of contemporary issues
 - Understand the issues related with the project and their impact to society and the project itself.

"Design" – Definition ?

- ABET
 - "The process of devising a system, component, or process to meet desired needs," which involves
 - "A decision-making process (often <u>iterative</u>), to convert resources optimally to <u>meet the stated needs</u>" by applying basic <u>sciences</u>, <u>mathematics and engineering</u>, adequately considering
 - <u>knowledge, standards</u>, and <u>constraints</u> related to the <u>electrical/computer engineering discipline</u>."
- Industry
 - (1)"Determine that a <u>need</u> exists with a customer for specific goods or services and how much that customer is able and willing to pay for it.
 - (2)Then determine if the product or service is <u>compatible with the</u> <u>competencies</u> of the company and if it can be manufactured at a <u>cost</u> that is less than the customer will pay.
 - (3) If so, proceed by designing to match the <u>company's ability</u> to manufacture, rather than basing the design on state-of-the-art technologies.
 - (4) Finally, prior to full implementation, prepare a pilot demonstration"

"Senior Design" Schedule

- Fall 2012
 - Understand the Design Processes and Components
 - Selection of Design Projects
 - Proposal for the Projects
 - Proposal Presentation
 - Initial Solution Generation
- Spring 2013
 - Alternative Solution Generation
 - Top Design Selection
 - Design Implementation
 - Design Evaluation
 - Final Presentation (ECE Day April 2013)

Regulatory Compliance – What is this?

• Example

Regulatory Compliance

United States v

Learn More About Dell

Corporate Responsibility

Regulatory Compliance

Company

Investor

News

Buy Online or Call 1-800-WW

Electromagnetic Compatibility

Dell products are designed, tested, and classified for their intended electromagnetic environment (domestic/residential environment or business/industrial environment). Electromagnetic Compatibility (EMC) is the ability of items of electronic equipment to function properly together in the electronic environment. While all Dell computer systems have been designed and determined to be compliant with regulatory agency limits for EMC, there is no guarantee that interference will not occur in a particular installation.

Required statements for the international EMC specifications, marks and approvals, as obtained and documented on the product specific Product Safety, EMC and Environmental Datasheet, are provided in applicable agency/country language(s). Examples of EMC specifications include, but are not limited to, CISPR 22 and FCC Part 15.

Electrostatic Discharge

 Regulat
 Dell products that have the CE marking are designed and tested for immunity to Electrostatic

 Dell Inc
 Discharge (ESD) to IEC standard 61000-4-2, CISPR 22, and CISPR 24. While these products

 have been designed and determined to be compliant with standard levels for ESD, there may be situations, such as low humidity levels, that can exacerbate ESD event occurrence. Users are encouraged to read and follow the ESD protection guidance provided within the Protecting Against Electrostatic Discharge section of this website.

- What are these?
 - CISPR22, FCC Part 15, IEC 61000-4-2, and CISPR 24.
- Warm-Up Homework (HW #1)
 - A file of 4 slides, each summarizing each of above 4 standards or specifications
 - Due: T September 4 by 2000 hour (Email submission to ckim@howard.edu)

Becoming a Technical Professional

18





Third Edition





CONCEPTION MARKET



Main Text and Resource

- Becoming a Technical Professional
 - by Vern Johnson and Reid Bailey
 - published by Kendal/Hunt Publishing Co.
 - 3rd Edition
 - ISBN 13:978-0-7575-2765-4
 - Written for first-year engineering students
 - Process/Idea is same for seniors with actual application & implementation of the process & idea.
- Helpful Books on System Integration with Intel Atom Processor Board
 - "Break Away with Intel Atom Processors" and
 "Study Guide" by L. M. Matassa and M. Domeika
 - "Modern Embedded Computing" by P. Barry and P. Crowley
 - Above two books are available for check out through the course offering
- Resources
 - Niku, Creative Design of Products and Systems, Wiley

Course Grading and Expectation

- Expectation
 - Attendance
 - Active Participation
 - Weekly Activities
 - Assignments
 - Actively seeking solutions
 - Active interaction with instructor and advisor
 - Everything counts
 - Professional manner

- Grading
 - Individual Score (X):40%
 - Attendance (10%): only on-time arrival counts
 - Homework +Others (20%)
 - Final Exam (10%)
 - Group Score (Y): 60%
 - Class activities + Assignments (30%)
 - Proposal + Presentation (30%)
 - Peer Evaluation Score (P): 0 1.0
 - FINAL SCORE (F)
 - F = X + Y*[0.6+ 0.4*P]
- Grades
 - A: 90 100
 - **B:** 80 89
 - C: 70 79
 - D: 60 69

Engineering Design – Topics and Objectives

- Topics
 - Engineering Design Overview
 - Problem
 Formulation
 - Problem Solving
 - Solution
 Implementation
 - The Art and Science of Creativity
 - Project Management

- Objectives
 - Understanding an engineering design process
 - Understanding the 3 phases of design and how design is an adaptive, systematic process
 - Applying a design process to meet a set of needs

– Design it!

Engineering Design-Overview

Problem Formulation

- Recognition of a set of needs
- Information gathering about the needs
- Determine the requirements of the project

Problem Solving

- Investigates the available alternatives to meet the requirements – Current State of the Art
- Generates and Analyzes and Specifies alternatives with the requirements
- Makes Decision on which alternatives will be implemented
- Selects the Top Design

• Solution Implementation

- Creates an <u>implementation</u> and test **plan**
- Follows the plan to **build** the design
- Evaluates against the requirements from problem formulation

Milestone

- Understanding Design Processes: September
- Project Topic Selection: September
- Team Formation: September
- Problem Formulation: October
- Problem Solving and Top Design Selection: November
- Design Implementation (initial stage): November December



Charles Kim – Howard University

Characteristics of Design

- Design is:
 - Process cycles through the 3 phases of Problem Formulation, Problem Solving, and Solution Implementation
 - systematic, not trial-and-error
 - adaptive, not a recipe (nor a cookbook)
 - process, not an event or product
 - Iterative back to earlier phases
 - Simultaneous in refinements of the needs/requirements
 - Done based on Engineering and Scientific Knowledge
 - To be Rigorous in testing and evaluation
 - To execute planned activities
 - To comply regulation, codes, rules, standards, etc
 - "Very demanding, overwhelming but awakening experiences that I utilized in my job interview and apply in my work now" – former student
 - " " (at the end of the class)

Design Project Topics

- Industry
 - Northrop Grumman
 - -NASA
 - Southern Company
 - PEPCO



- SDG&E Transformer Condition Monitoring?
- National Level Competition & Challenge
 - Cornell Cup 2013 Competition
 - Others: Hydrogen etc ?
- In-House
 - Continuation of the last semester projects?

Southern Co – Mr. Blue

- Self Healing network reconfiguration after a fault (signal phase solution)
 - This would be good project of utilizing expert system to make decision for isolating outages and restoring customers
- Radial Distribution Network Analysis (voltage correction and load shedding with Dynamic Load Changing)
 - This would be a good power system analysis project for optimizing distribution system network with a little probability to make it a dynamic system.
- AMI Assisted Network Analysis (OMS)
 - This will be a good model to help assist in figuring out what customers are affected during random outages. Because of cost and lack of IED (Intelligent Electronic device) the prediction of customers out and reliability indices are not always accurate. [Also, the estimation resources is not accurate.] This is problem because outages at the fuse taps (which can carry 1 to about 50 customers on a signal phase tap). Have an accurate network model is important. This does not have to be graphical.

Cornell Cup 2013

- 2nd USA national contest for embedded systems
 - Howard teams success
- College-level embedded design competition created to empower student teams to become the inventors of the newest innovative applications of embedded technology.
- Expected Launch Date: Oct 2012
- http://www.systemseng.cornell.edu/intel/
- Teams of 3-5 students will create detailed design plans, a working prototype, and a final presentation that effectively demonstrates the capabilities and robustness of their ideas.
- Applications and final report entries will be "blind" reviewed by a team of experts and all judging criteria is made openly available to all contestants
- Intel Atom board based Design and Implementation

Cornell Cup 2012 Topics



The Inaugural



Cornell Cup USA Presented by Intel







Solar Drone University of California, Berkeley

The problem of long-endurance flight has yet to be adequately solved with unmanned aerial vehicles (UAVs). Conventional powertrains are typically disadvantaged by limited capacities for non-renewable fuels, but in theory a renewable energy source would permit self-sustaining flight. However, most formal research to date concentrates on developing aircraft with immense wingspans, while overlooking miniature UAVs due to difficulties with effective downscaling. This team intends to bridge that gap by demonstrating multiple-day flight using an autonomous solar-powered UAV with a wingspan of 3m or less.

Sentinel

University of California, San Diego

The Intelligent Wildlife Video Recording System "Never before seen footage" is powerful because it provides a new perspective on the universe. All of a sudden, the world isn't the same anymore; the universe's dynamic nature is laid bare for all to see.

Columbia SWARM Columbia University

There are numerous environments that for a myriad of reasons are inaccessible to human exploration. Our project plans on being a way to solve the problem of mapping out these environments by using a heterogeneous swarm of microcontroller controlled robots that autonomously take sensor readings and use this data to build a map of their environment. The exciting aspect of this project is that it is extremely applicable to being used in disaster relief zones, hostile environments and space exploration.

GT Accessors Georgia Institute of Technology

Accessibility focuses on the degree to which people with disabilities can interact with the world around them. Unfortunately, most embedded applications (apps) for smartphones and tablets are not designed with accessibility in mind, especially for those with upper-body motor impairments. Imagine therefore the ability to expand access to technology if we provide alternative input interfaces to increase accessibility to tablet-based applications.

Team Alpha – GT Night Rover Georgia Institute of Technology

The Intel Cornell Cup will provide a platform on which to perfect engineering designs and computing algorithms for the GT Night Rover. The GT Night Rover aims to store and utilize electrical and/or thermal energy efficiently while investigating systems for prolonging the useful mission life of a robotic planetary rover (planetary in the general sense). The final prototype will be an autonomous rover that locates sources of solar energy and continues moving through a full day/ night cycle. This challenge will serve as a proof

Audio(G)Fusion University of Houston

Audio(G)Fusion integrates an Intel processor with an electric guitar. The user may alter audio filters using a touchscreen that is mounted to the body of the guitar. Once the user has configured a filter, they may assign the filter to a preset button to quickly enable or disable it while performing. The user may choose any combination of filters. The maximum number of filters is limited only by the Intel processor's power.

Green Lighting Howard University

The goal of this Green Lighting project is to implement a system that will enhance the work environment in a given room by regulating the intensity of the lights throughout the day, while minimizing energy costs. This is to address the energy costs associated with maintaining standard or optimal lighting conditions for a workspace. The system will consist of light sensors connected to low-end microcontrollers for each relevant sector of the room which link back to a Tunnel Creek board which will process the data, make decisions as to how the intensity of each light fixture should be varied to maintain lighting standards, or user preference, and command the instruction to the lighting control circuitry. In

AAPS – Automated Aero-Painting System University of Massachusetts, Amherst Unmanned aerial vehicles (UAV) are destined to revolutionize aviation technology. Though UAVs have served a variety of applications, there is still a need for reliable automation. To measure automation reliability, we must measure communication sustainability, functional feedback and autonomous decision making. For our particular project we will equip a quadrocopter with a spray paint canister, and set it up to paint a figure autonomously on a vertical surface.

Kim – Ho

Team Wolf

University of Massachusetts, Amherst The vision of augmented reality is to provide users with relevant information to supplement their normal interactions with their environment. This technology promises to fundamentally improve many common applications that currently require specific devices or cumbersome interactions (e.g., driving directions, searches for local information, information about individuals with whom we interact, etc.). To achieve this vision, however, there are numerous technical challenges that still need to be addressed.

IVS

Portland State University

Nowadays, the development of medical care helps to save millions people and cure numerous known diseases. However, the introduction of a substantial number of pills and drugs that follows has made identifying them increasingly challenging and time-consuming. In 2006, out of 100 persons, 46 persons have to come to the emergency rooms (ERs) and averagely spent 2.6 hours [1]. To address the problem, this paper will propose a solution namely Prescription Drug Identification device (PDI) which is capable of minimizing time, increasing accuracy and providing detailed instant drug information to both patients and doctors. The device is designed mainly for ERs but can also be used in doctor offices or at home.

JouleCycle Team University of Massachusetts, Lowell

Obesity is recognized as serious public health problem that leads to many illnesses such as diabetes and heart disease. According to CDC, about one-third of U.S. adults and 17% of children and adolescents aged 2-19 years are obese. As getting exercise is an effective way to control obesity, the team proposes to design a gaming system called "JouleCycle" to help people get regular exercises and achieve caloric balance. The gaming system is built upon a human powered bicycle and an Intel Atom development board without using any battery.

The Incredible HUD Purdue University

The Incredible HUD (the device) is a novel approach to the subject of compact, portable headsup displays. There is a growing need for compact, rugged and highly integrated augmented-reality displays that provide relevant and real-time information to the user. Be it motorsport, extreme sports, or even defense applications, there is no shortage of applications for a device that can enhance the user's awareness of his/her surroundings. Current solutions are too expensive, too delicate, too bulky, or too complex for mass consumer appeal. This gives rise to challenges such as optics, weight, power consumption and device stability and durability.

Team DART Seattle Pacific University

According to the Humane Society four out of ten U.S. households have a dog. This leads to a common problem and nuisance in today's society: picking up dog waste from one's yard. This practice is inconvenient and requires precious time out of every dog owner's day. There are numerous companies that specialize in services dealing with the removal of dog waste, but these services are expensive and can quickly add up over time. The average dog may produce waste several times per day! Our team's proposed solution to this problem is the AWR (Autonomous Waste Remover).

Team VISIONary University of Southern California

Approximately 1.3 million people are legally blind in the United States. In the world, there are approximately 285 million people with some kind of visual impairment. These people have difficulty navigating in both indoor and outdoor environments. Many existing solutions partially solve the outdoor navigation problem but little attention is being given to the indoor navigation problem. As a result our team proposes a solution that integrates a Local Position Detection System (LPDS) with a Navigation System (NS) to successfully navigate a user through an indoor environment.

Hot Dawgs

Southern Illinois University at Carbondale

According to the Department of Energy, in 2005, heating and cooling a house comprised around 49% of all household energy usage (1). The cost of heating and cooling homes is, on average in 2005, over \$800 a year (2). The installation of a programmable thermostat can save \$180 a year if set properly (3) .This is still only one sensor that may or may not be in an ideal location in the home.

Knights of the Workbench Vermont Technical College

The irresponsible consumption of alcohol is an undeniable international problem. From the operation of motor vehicles while under the influence, to drunken bar fights; it is certain that wherever alcohol is involved the situation has a greatly increased level of danger. The current limitation of bartenders is their ability to recall the contents and quantity of drinks served to bar patrons, and to comply with legal policies regarding alcohol consumption, such as age limitations. These responsibilities are by no means easily manageable within the variable environments which alcohol is normally served.

s Kim – Howard University

Think Chair

Worcester Polytechnic Institute

The aim of this project is to instrument a wheelchair with an intuitive control and navigation system that integrates voice recognition, face tracking, and hand gesture interpretation. It allows the user to easily select his or her preferred method of control depending on situational demands or personal needs. This robotic wheelchair will use the Intel Tunnel Creek platform and the Atom processor to perform necessary computations. The system will actuate the power wheelchair base, determine when the user is controlling the robot and combine multiple interfaces

The FIVOLTS

Worcester Polytechnic Institute

Daytime drowsiness and fatigue lead to decreased driving reliability, lower working efficiency and fatal accidents. According to recent research, heart rate variability can be robustly calculated from the photoplethysmogram (PPG) to indicate parasympathetic nervous activity and classify drowsiness level.

for greater usability.

Wild Card Winner Team Summary

Blind Assist Howard University

According to the National Federation of the Blind, "The real problem of blindness ... is the misunderstanding [of their surrounding]".

As a solution to this issue, this team proposes a device that assists the blind in navigating their surroundings. The device will function as a GPS guidance and obstacle avoidance system. We can offer this functionality though components including a sonar sensor, GPS receiver, and an Internet modem. Our avoidance system will use sonar to detect objects to protect users from collisions with obstacles. The sonar sensor will be connected to a microcontroller that sends data back to the Tunnel Creek Board for processing. The system will then send a command to the user alerting them of upcoming obstacles.



Homework #2 -- " [Your own title/subject here]"

- A building on 8620 Spectrum Center Blvd, San Diego, CA ("Sunroad Spectrum 12 Office Tower") – Now <u>Ashford University</u>
- Difference between two photos of the same building is about \$20M. Left (summer 2008). Right (Summer 2009)





Homework #2 Instruction

- Investigation of the happening around the building
- Should answer all the questions of:
 - What happened?
 - How it happened?
 - Why it happened?
 - How could it be avoided
 - What is the general lesson from the happening?
- Individual Work
- Written report (hardcopy only)
 - Concise, technical, professional,
 - News staff writer-like report --- the importance of the first paragraph.
 - With your own words.
 - No cover sheet; no photos; no drawings; TEXT ONLY
 - Letter size, 1" margin all sides, 12 pt. Times New Roman font. Single column. Single space. Min 2, Max 3 pages.
 - Pick your own title less than 10 words
 - Due: Bring it to W Septer 2 iolassard University

News Staff Writer Style? Compare 2

By Andrew Quinn BEIJING | Wed Sep 5, 2012 7:45am EDT

(Reuters) - China and the United States were divided on Wednesday over how to end the bloodshed in Syria and defuse tension in the South China Sea and other global troublespots, but stressed hope for steady ties as they navigate political transitions at home.

U.S. Secretary of State Hillary Clinton and Chinese Foreign Minister Yang Jiechi vowed goodwill after talks which had been preceded by criticism from Beijing of Clinton's calls for a multilateral solution to the territorial disputes in the South and East China Seas.

Clinton told reporters that such disagreements did not have to hobble cooperation.

"I'm very proud of the strength and resilience that we have built into our relationship," she said after talks with Yang in the cavernous Great Hall of the People in Beijing.

"It makes it possible for us to talk about anything, and to find ways to tackle issues frankly and forthrightly," Clinton said, adding that the two sides would not see eye-to-eye on all the issues that are part of their vast relationship.

Yang also cast relations in a positive light, saying both sides could work together as long as "mutual respect for each other's core interests and major concerns" continues.

The Philadelphia Eagles don't start their season until Sept. 9 against the Cleveland Browns. Yet Eagles fans like myself know full well that the season really begins on Sept. 5. And unlike most of the other 29 teams still waiting around to kick off, there is extra reason for Philadelphia to pay attention to the year's very first game.

To reach their big goals, the Eagles will probably need to win the NFC East - and to do that, they must dethrone the defending division and Super Bowl champion New York Giants. But Philadelphia also has to hope that the Dallas Cowboys can't overtake New York first. As such, it will be required viewing in Philadelphia to see Dallas and New York meet on opening night on Sept. 5.

The best hope for the Eagles is that neither of them look good, which could be plausible. Expectations have gone down for the Cowboys recently, with Jason Witten doubtful to play and Miles Austin and Dez Bryant also banged up. Given the two gut wrenching losses the Cowboys suffered to the Giants late last year which changed the entire direction of the season - Dallas has to hope that New York doesn't have its number.

Yet expectations are also middling for the Giants, despite their championship. Given that they merely caught fire late last season just like in 2007 - that the Green Bay Packers, San Francisco 49ers and Eagles are still in the NFC, and that New York is not an

Example Microsoft, Nokia pin hopes on new Lumia as mobile war escalates

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By Tarmo Virki and Sinead Carew HEL SINKI/NEW YORK | Wed Sep 5, 2012 3:15am EDT

(Reuters) - Nokia and Microsoft Corp will take the wraps off the struggling European company's most powerful smartphone on Wednesday, in what may be their last major shot at winning back a market lost to Apple, Samsung and Google.

The world's largest software maker and the Finnish company that once dominated the cellphone market will showcase the device in New York on Wednesday morning and demo it for industry insiders about the same time

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