

**EE/CpE 423**

**Senior Design**

**Fall 2007**

**Class 1**

# Course Introduction

- Logistics:
  - Course coordinator: Bruce McNair
    - Office: Burchard 206
    - Phone: 201-216-5549
    - email: [bmcnair@stevens-tech.edu](mailto:bmcnair@stevens-tech.edu)
    - Web site: <http://koala.ece.stevens-tech.edu/~bmcnair>
  - TA: Mary Schurgot ([mschurgo@stevens.edu](mailto:mschurgo@stevens.edu))
- Class schedule:
  - Generally, 1 hour Tuesday sometime between 3 – 5:50 pm
  - **LET ME KNOW ABOUT TIME CONFLICTS ON TUESDAY – I'LL SCHEDULE CLASS TIME TO MINIMIZE THEM. Class time will be 3 pm for now.**
  - Fall group presentations may require full class schedule time and Thursday meetings  
**THERE WILL OTHERWISE BE NO EE/CpE423 MEETINGS ON THURSDAY**
- Class web site:

Access thru WebCT is set up. Site is also be mirrored on a site that is externally accessible:  
<http://www.ece.stevens-tech.edu/sd/>

You will also be able to access via my web site

Most of previous years' senior design groups' sites are archived (esp. since F'02)

All of my slides will be posted on my web site and the SD web site.

# A personal perspective

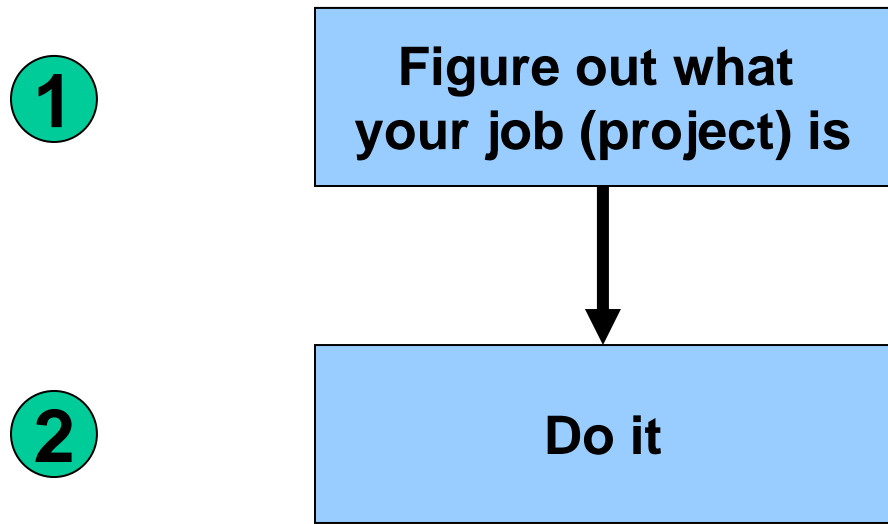
- My perspective on senior design
  - As a Stevens '71 student
  - As an AT&T/Bell Labs technical recruiter from 1982-1996
  - As a faculty member

# Senior Design Consists Of Only Three Tasks!!

**1**

**Figure out what  
your job (project) is**

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1

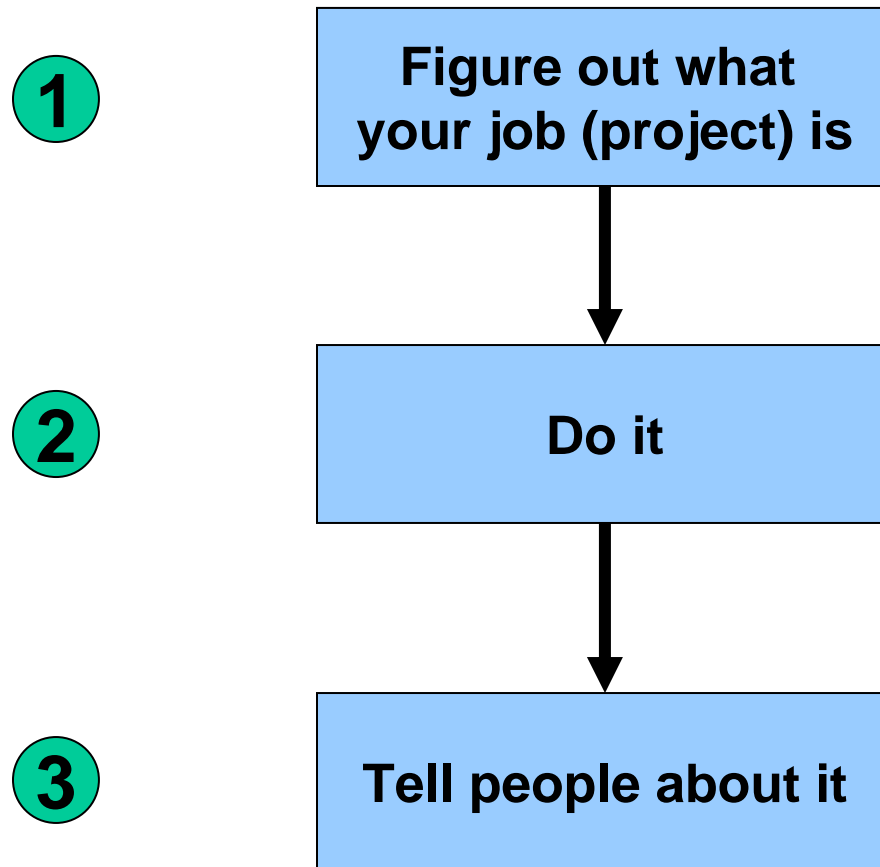
**Figure out what  
your job (project) is**

2

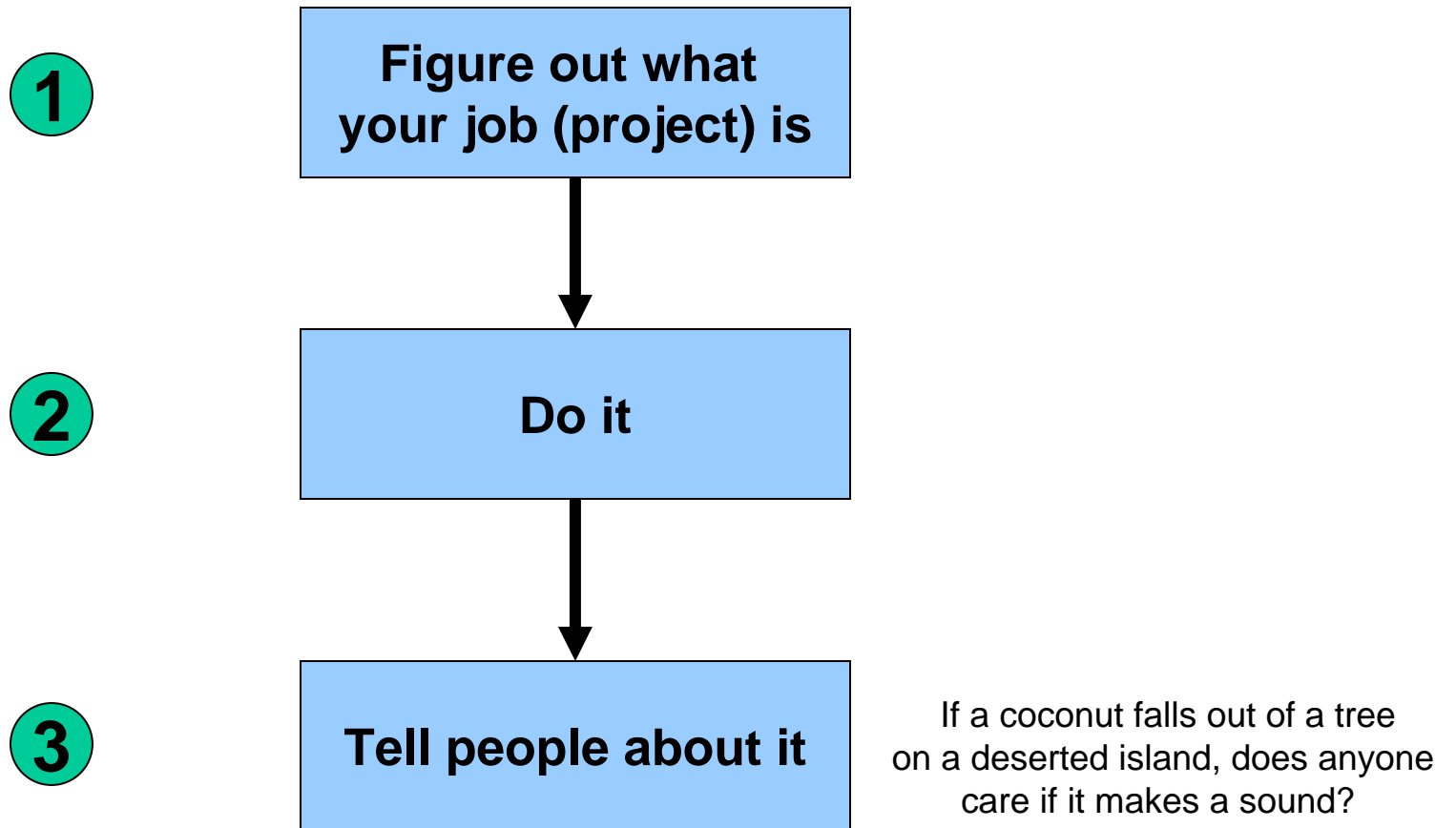
**Do it**

Task #2 becomes easy if Task #1 is well thought out. If you start Task #2 without fully completing Task #1, it may be a bit more difficult

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# Senior Design course flow

## 1. Project identification

- What is the problem you are trying to solve?
- Is it interesting?
- Is it doable?
- Is it meaningful?
- Can you find a sponsor?

## 2. Group formation/selection of Group Leader

- ~4-5 students/group
- Equal share in outcome of project \*\*\*\*
- Group leader keeps project on target (time and direction) and is responsible for reporting

## 3. Find a Faculty Advisor

- **Must** be a member of ECE, CS, or Physics Departments' faculty
- Evaluates written reports
- Determines 80% of group grade

# Senior Design course flow (continued)

4. Submit Project/Advisor Form – due by 9/11/07
  - Completed after project and advisor are selected.
  - Faculty advisor signs, group submits to course coordinator (me)
  - I assign a group number that is used in all future reports
  
- Weekly Status Reports - first report due the Monday after group number assigned
  - From group leader to course coordinator (me): an electronic one page summary of project status, progress for the week. CC: advisor, TA, and tutor
  - Due **before** Noon Monday via email. Send .pdf or .doc file
  - Format/template on web site – don't deviate
  - “Hours spent on project” are for CURRENT week, report person-hours (e.g., group of 4 met for 2 hours = 8 person-hours)
  
- Advisor-Group Meetings/Oral and Written Progress Reports
  - Meet with advisor **at least** once every two weeks, preferable weekly
  - Advisor provides technical guidance, advice to group
  - All students must attend advisor-group meetings
  - Advisor signs written interim and final reports

# Senior Design course flow (continued)

- Logs
  - Every student must maintain an up-to-date laboratory notebook, recording time spent on project, observations, directions, dead-ends, etc..
  - Must be made available on request to advisor, coordinator, other faculty
- Documentation required (in order)
  - Project/Advisor form – early in first semester
  - Project Proposal – middle of first semester
  - Individual project web site (start creating during Fall semester)
  - Final Design report – end of first semester
  - Project Oral Presentation – end of first semester
  - Interim Progress report – middle of second semester
  - Poster/Project demonstration – end of second semester
  - Final Report – end of second semester

# Senior Design course flow (continued)

- Class Meetings
- Grades
  - 80% assigned by advisor
  - 20% assigned by course coordinator
- Awards
- Materials & Supplies
- Facilities
- Patents and IP

# New or Improved this year

- Design Spine Communications Workshops/tutoring will be part of Senior Design
- Provisional patent filing on Senior Design projects

# Technical Advisors and their Research Areas

<p><b>Barry Bunin</b></p> <ul style="list-style-type: none"> <li>• Internet technologies</li> <li>• Broadband access</li> <li>• Telecommunications</li> <li>• Maritime security</li> </ul>	<p><b>Rajarthanam Chandramouli</b></p> <ul style="list-style-type: none"> <li>• Networked Communications</li> <li>• <b>Wireless</b> Communications</li> <li>• <b>Multimedia</b> Computing and <b>Security</b></li> <li>• Energy Efficient Coding for <b>Wireless</b> Communications</li> </ul>	<p>Yingying (Jennifer) Chen</p> <ul style="list-style-type: none"> <li>• Wireless and system security</li> <li>• Security and software in distributed systems</li> <li>• wireless and sensor networks</li> <li>• Network systems</li> <li>• Bioinformatics</li> <li>• Statistical methods and machine learning to classify and model systems</li> </ul>
<p><b>Cristina Comaniciu</b></p> <ul style="list-style-type: none"> <li>• QoS for <b>wireless</b> networks</li> <li>• Cross-layer design for <b>wireless</b> networks</li> <li>• <b>Radio</b> resource management</li> <li>• Admission/access control for <b>multimedia</b></li> <li>• <b>Spread spectrum</b> communications</li> <li>• Multiuser detection &amp; multi-access protocols</li> </ul>	<p><b>Yi Guo</b></p> <ul style="list-style-type: none"> <li>• Control systems (particular non-linear)</li> <li>• Cooperative autonomous systems</li> <li>• Stability modeling of computer networks</li> </ul>	<p><b>Haibo He</b></p> <ul style="list-style-type: none"> <li>• Dynamically reconfigurable systems</li> <li>• self-organizing systems</li> <li>• learning arrays</li> <li>• associative arrays</li> <li>•</li> </ul>
<p><b>Harry Heffes</b></p> <ul style="list-style-type: none"> <li>• Integrated Broadband Communications Networks</li> <li>• Overload Controls for Distributed Switching Systems</li> <li>• Queuing and Teletraffic Theory and Applications</li> <li>• Computer Performance Modeling and Analysis</li> <li>• Mobile Communications and Congestion Control for High Speed Networks</li> </ul>	<p><b>Victor Lawrence</b></p> <ul style="list-style-type: none"> <li>• Data Communications</li> <li>• Signal processing</li> <li>• Speech and image processing</li> <li>• IP networking</li> </ul>	<p><b>Hongbin Li</b></p> <ul style="list-style-type: none"> <li>• Signal Processing for Communications</li> <li>• Channel Identification and Equalization</li> <li>• <b>Transmit/Receiver</b> Diversity</li> <li>• <b>CDMA</b> and <b>OFDM</b> Systems</li> <li>• Stochastic Signal Processing</li> <li>• Sensor Array Processing</li> <li>• Detection and Estimation</li> <li>• Spectral Analysis and System Identification</li> <li>• <b>Radar</b> and Medical Imaging</li> </ul>
<p><b>Hong Man</b></p> <ul style="list-style-type: none"> <li>• <b>Image</b> Compression</li> <li>• <b>Video</b> Compression</li> <li>• Error Resilient Data Compression</li> <li>• <b>Wireless</b> Data Communications</li> </ul>	<p><b>Yan Meng</b></p> <ul style="list-style-type: none"> <li>• Real-time Embedded Systems</li> <li>• Computer Vision</li> <li>• Robotics</li> <li>• Communications Networks</li> </ul>	<p><b>Bruce McNair</b></p> <ul style="list-style-type: none"> <li>• <b>Wireless</b> Communications</li> <li>• Computer and Network <b>Security</b></li> <li>• Signal Processing for Communications</li> <li>• Software-Defined <b>Radios</b></li> <li>• OFDM <b>Wireless</b> Systems</li> <li>• <b>Wireless</b> LANs</li> <li>• Real-time Embedded Systems</li> <li>• Broadband Power Line Systems</li> </ul>

# Technical Advisors and their Research Areas

<p style="text-align: center;"><b>K.P Subbalakshmi</b></p> <ul style="list-style-type: none"> <li>• Joint Source-Channel Coding</li> <li>• <b>Image</b> and <b>Video</b> Coding</li> <li>• Error Resilient <b>Multimedia</b> Communications</li> <li>• <b>Multimedia</b> Networking</li> </ul>	<p style="text-align: center;"><b>Stuart K. Tewksbury</b></p> <ul style="list-style-type: none"> <li>• VLSI and ULSI Digital Systems</li> <li>• System Interconnects &amp; Packaging</li> <li>• Communications for Concurrent Computing</li> <li>• Reconfigurable Computing Systems</li> <li>• Computation Science &amp; Engineering</li> </ul>	<p style="text-align: center;"><b>Uf Tureli</b></p> <ul style="list-style-type: none"> <li>• CDMA-Based <b>Wireless</b> Systems</li> <li>• <b>Wireless</b> Testbeds</li> <li>• OFDM <b>Wireless</b> Systems</li> <li>• Signal Processing for Communications</li> </ul>
	<p style="text-align: center;"><b>Yu-Dong Yao</b></p> <ul style="list-style-type: none"> <li>• Microcellular <b>Wireless</b> Architectures</li> <li>• Equalization for Co-Channel Interference</li> <li>• <b>Spread Spectrum</b> for Indoor and Mobile <b>Wireless</b></li> <li>• Mobile <b>Satellite</b> Communications</li> </ul>	

# 2002-2003 Projects

**Chaotic Spreading Spectrum System Development and Implementation  
using FPGA/VHDL for Secure Wireless Communications**

**Kalman Filter Library**

**Autonomous Advertising Robot Interface**

**Factory Deviation Monitor**

**Data Center Environmental Link**

**MyStevens**

**Voice Over IP at Stevens**

**Missile Course Deviation**

**Motion Tracking Device**

**Platform for Media Riche Lecture Delivery**

**Redesign of the Stevens Campus Network**

**Youth Monitoring Device**

**eHousing**

**Real-time Wireless Sensor Network – Signal Analysis for Security**

**Applications  
Home Calling Center**

**Miniaturization of MP3 Player**

**Cell Phone – Brew Based Cellphone Application Development**

**Smart Appliances**

**“Universal” Credit Card**

**Digital Fingerprint Scanner**

**Blue Force Tracing Geolocation Services**

**Self Tuning Guitar**

**Wireless Cargo Tracking using 802.11a Technology**

**EZPARK**

**Financial Management Software**

**Remote Camera Control**

**H-26L Video Coding Standard**

**Autonomous Underwater Vehicle**

**Secure Data Transfer System**

**Web-based Information Tracker**

**Real-time Multimedia Steaming System w/ advanced  
compression & steganography algorithms over wireless channels**

**Automobile Black Box**

**GPS tracking for RF transceivers**

**Digital Player Piano**

**LED Learners Guitar**

**Modular LED Display**

**Digital Video Surveillance System**

**Media Pad**

**Electronic Caddy**

# 2003-2004 Projects

Wireless Biomedical Sensor

Environmentally Aware GPS

Wireless MP3 Player

Thumb-thing

Adaptive Communications thru  
Software Defined Radio

Automatic Mailbox Notification System

Solid State Hard Drive

GPS Mass Transit Tracker

Trans-verbal-ator

Gameboy Advance PAL

DBNS Filter

iTea – Information Transportable  
Electronic Assistant

Hexaphonice Digital Mixer

Bluebird – Bluetooth Universal Remote

SmartNet

Voice Actuated Remote Control

Face Recognition Using Artificial  
Neural Networks

Intelligent Cellular Docking Station

Variable Frequency Skin Impedance Monitor

AUV: Computer and Navigation System

FLASH: All in One Portable Player

Programmable Sculpture

Dynamic Spectrum Analyzer

# 2004-2005 Projects

**Robotic Landmine Detection**

**Autonomous Helicopter - Sensors**

**Autonomous Helicopter – Guidance/Logic**

**Stevens Web-Wash**

**Spectral Sharing Through  
Multidimensional Reuse**

**Continuous roll film scanner for 35mm  
and medium format film**

**Real-time Adaptive Traffic Control Systems  
and Analysis of Traffic Patterns**

**Wireless Drifter**

**Virtual Enterprise Network**

**RFID Checkout**

**Failure Detection System for Moving Bridge**

**Remote Surveillance Vehicle**

**Linux Video Conferencing**

**Iris Recognition System**

**DMX-to-Ethernet**

**Multinetwork roaming using VoIP**

**Voice Activated Keyless Entry Watch**

**Mortar Sensor System**

**R.I.N.G – Ring Identifier Network Grounds**

**RF Transceiver Testbed for ISM Bands**

**Remote Diver**

**Lifesaver**

**Spectrum Analyzer for Dynamic Access (SADA)**

**Gameboy Advance GPS Cartridge**

**(VACS) Voice Activated Control System**

**Secure Entry System**

**Control Systems and Sensor Packages  
(CSSP) for UAVs**

**Perfect Popcorn Popper**

**Innertchill System Cooler**

# 2005-2006 Projects

**Digital camera wireless storage unit**

**Registrar scheduler**

**Dynamic Classroom**

**GPS guided mobile platform**

**Networked online backup system**

**Mobile video streaming**

**MicroSpy Biochip**

**Autonomous Exploratory Robot**

**RFID airline baggage tracking**

**GenBlu**

**Aloha: Simulation of random access system**

**Data acquisition and storage system**

**Wireless VoIP**

**NYC OEM Disaster Recovery Plan**

**Wireless monitoring of vital signs in small animals**

**Runner's Health-O-Meter**

**Mobile Medic**

**RF modular front end**

**RF MetroPass**

**Campus emergency location system**

**Expansion of ComBlock network**

**"Smart Card" virtual sign-up sheets**

**Emergency communications system**

**Dynamic multi-sensor fusion, monitoring, and tracking network**

**Limited interactive system for (home) automation**

# 2006-2007 Projects

**Wireless power control**

**Electronic scoring of archery**

**MIMO ComBlock Testbed**

**Noise canceling window**

**Intelligent Autonomous Search System**

**Location of users in wireless LAN**

**Software defined radio – frequency converter**

**Software defined radio – broadband antenna**

**Emergency communications system**

**Wireless Drifter**

**Runner velocity measurement**

# Potential projects for 2007-2008

- ECE component of SAE Formula hybrid vehicle (with ME department)
- ECE component of “Green” housing (with Civil, other departments)
- Wireless, distributed school bell controller
- PC/soundcard-based OFDM modem for HF communications
- Solar-powered home appliances
- Signal processing for biomedical systems (with Biomed)

# Assignment for 9/4

- Identify a problem that you would like to see a solution for. DO NOT describe a technology or a solution to a problem that may not exist.
- Describe the problem in sufficient detail (~1 paragraph) that would allow a group to start a project to address it.
- E.g.:
  - A problem:  
I have many large piles of books and magazines in my office and at home. I can never find the specific item that I want when I need to refer to it. I don't want to take the time to file each item away. I would like to be able to place items in their respective piles and know where every item is.
  - A related problem:  
Items in my house (including one or more of my cats) often disappear into unlikely hiding places. I would like a system that provides a real-time inventory of what is in the house and where it is or was recently
- The first problem statement might lead a group to design a bar code printer/scanner and a database that allows me to look up titles, ISBN, content, etc., responding with the pile location and the approximate position in the pile. (it would keep track of which pile the item is in, when the item got placed onto the pile and the relative age of the pile). By thinking about the two problems, an autonomous robot (Roomba without a sweeper) with an RFID tracker might also be a solution

**I do NOT want the solution – there are many alternatives.  
I want the succinct problem description.**

# Senior Design Tasks – Fall '07

