What to Expect in Senior Design

Bruce McNair
bmcnair@stevens.edu
http://koala.ece.stevens.edu/~bmcnair
Introduction

• Logistics:
  – Course coordinator: Bruce McNair
    • Office: Burchard 206
    • Phone: 201-216-5549
    • Email: bmcnair@stevens.edu
    • Web site: http://koala.ece.stevens.edu/~bmcnair
  – TA: Dominik Hepp ’03: dhepp@stevens.edu

• Class schedule:
  – Generally, 1 hour Tuesday sometime between 3 – 5:50 pm, as needed
  – Fall group presentations require full class schedule time and Thursday meetings
  – Senior design is a 0-8-3 course

• Class web site:
  http://koala.ece.stevens.edu/sd
  All 2002-2003 and 2003-2004 projects are archived. Many before that, as well
A personal perspective

• My perspective on senior design:
  – As a ’71 student
  – As an AT&T/Bell Labs technical recruiter from 1982-1996
  – As a faculty member
  – As a design engineer
Your three tasks

1. Figure out what your job (project) is
2. Tell people about it
3. Do it
Senior Design course flow

1. Project identification
   - 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
   - Provides project technical guidance
   - Evaluates written reports
   - Determines 80% of group grade
Senior Design course flow (continued)

Documentation required (in order)
- Project/Advisor form – Fall semester, ~Week 2
- Weekly reports – one/group, by Monday Noon each week of classes
- Team Effectiveness Surveys – one/per person by Monday Noon each week of class (does not influence individual grades)
- Project Proposal – middle of Fall semester
- Individual project web site
- Final Design report – end of Fall semester
- Project Oral Presentation – end of Fall semester
- Interim Progress report – middle of Spring semester
- Poster/Project demonstration – end of Spring semester
- 3” x 7” project brochure
- Final Report – end of Spring semester
Stages in Development Cycle

- Basic Research
- Applied Research
- Exploratory Development
- Advanced Development
- Prototype / Initial Product Development
- Market Trials
- Final Product Development

Development of Technology → Proof of Feasibility of Technology → Refinement of Technology → Application of Technology

Suitable for Senior Design → Market Trials
Constraints That Can (Should?) Be Relaxed For Prototype

• Physical size
  – Level of integration (VLSI vs. FPGA, μC, LSI/MSI, etc.)

• Implementation platform
  – simulating a Palm on a laptop,
  – simulating functions in software that would normally be in hardware, and vice versa

• Feature set
  – What is essential to demonstrate concept, vs. what could be imagined/assumed
  – What is known to be doable vs. what is to be demonstrated

• Performance
  – Speed, capacity, etc.

• Environmental constraints
  – Operating temperature range, shock, vibration, etc.

➤ Focus on key attributes of end design, not every detail
## Technical Advisors and their Research Areas

<table>
<thead>
<tr>
<th>Advisor</th>
<th>Research Areas</th>
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</thead>
<tbody>
<tr>
<td>Francis T. Boesch</td>
<td>- Network Design&lt;br&gt; - Network Reliability&lt;br&gt; - Applications of Graph Theory</td>
</tr>
<tr>
<td>Rajarthanam Chandramouli</td>
<td>- Networked Communications&lt;br&gt; - Wireless Communications&lt;br&gt; - Multimedia Computing and Security&lt;br&gt; - Energy Efficient Coding for Wireless Communications</td>
</tr>
<tr>
<td>Cristina Comaniciu</td>
<td>- QoS for wireless networks&lt;br&gt; - Cross-layer design for wireless networks&lt;br&gt; - Radio resource management&lt;br&gt; - Admission/access control for multimedia&lt;br&gt; - Spread spectrum communications&lt;br&gt; - Multiuser detection &amp; multi-access protocols</td>
</tr>
<tr>
<td>Harry Heffes</td>
<td>- Integrated Broadband Communications Networks&lt;br&gt; - Overload Controls for Distributed Switching Systems&lt;br&gt; - Queuing and Teletraffic Theory and Applications&lt;br&gt; - Computer Performance Modeling and Analysis&lt;br&gt; - Mobile Communications and Congestion Control for High Speed Networks</td>
</tr>
<tr>
<td>Chandra Kintala</td>
<td>- Software fault tolerance&lt;br&gt; - Software rejuvenation and self-healing&lt;br&gt; - Distributed Application Architectures and Protocols&lt;br&gt; - Network Management and QoS&lt;br&gt; - Descriptional Complexity Theory</td>
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## Technical Advisors and their Research Areas

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| **Hongbin Li**           | • Signal Processing for Communications  
                          • Channel Identification and Equalization  
                          • Transmit/Receiver Diversity  
                          • CDMA and OFDM Systems  
                          • Stochastic Signal Processing  
                          • Sensor Array Processing  
                          • Detection and Estimation  
                          • Spectral Analysis and System Identification  
                          • Radar and Medical Imaging |
| **Hong Man**             | • Image Compression  
                          • Video Compression  
                          • Error Resilient Data Compression  
                          • Wireless Data Communications |
| **Bruce McNair**         | • Wireless Communications  
                          • Computer and Network Security  
                          • Signal Processing for Communications  
                          • Software-Defined Radios  
                          • OFDM Wireless Systems  
                          • Wireless LANs  
                          • Embedded system design  
                          • Real-time systems  
                          • Broadband Power Line systems |
| **K.P Subbalakshmi**     | • Joint Source-Channel Coding  
                          • Image and Video Coding  
                          • Error Resilient Multimedia Communications  
                          • Multimedia Networking |
| **Stuart K. Tewksbury**  | • VLSI and ULSI Digital Systems  
                          • System Interconnects & Packaging  
                          • Communications for Concurrent Computing  
                          • Reconfigurable Computing Systems  
                          • Computation Science & Engineering |
| **Uf Tureli**            | • CDMA-Based Wireless Systems  
                          • Wireless Testbeds  
                          • OFDM Wireless Systems  
                          • Signal Processing for Communications |
## Technical Advisors and their Research Areas

<table>
<thead>
<tr>
<th>Yu-Dong Yao</th>
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<tbody>
<tr>
<td></td>
<td>• Microcellular Wireless Architectures</td>
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<td></td>
<td>• Equalization for Co-Channel Interference</td>
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<td></td>
<td>• Spread Spectrum for Indoor and Mobile Wireless</td>
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<td>• Mobile Satellite Communications</td>
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## 2002 Projects

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<tr>
<th>Project Description</th>
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<tbody>
<tr>
<td>Chaotic Spreading Spectrum System Development and Implementation using FPGA/VHDL for Secure Wireless Communications</td>
<td>Redesign of the Stevens Campus Network</td>
<td>Blue Force Tracing Geolocation Services</td>
</tr>
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<td>Kalman Filter Library</td>
<td>Youth Monitoring Device</td>
<td>Self Tuning Guitar</td>
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<td>Autonomous Advertising Robot Interface</td>
<td>eHousing</td>
<td>Wireless Cargo Tracking using 802.11a Technology</td>
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<td>Data Center Environmental Link</td>
<td>Home Calling Center</td>
<td>Financial Management Software</td>
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<td>MyStevens</td>
<td>Miniaturization of MP3 Player</td>
<td>Remote Camera Control</td>
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<tr>
<td>Voice Over IP at Stevens</td>
<td>Cell Phone – Brew Based Cellphone Application Development</td>
<td>H-26L Video Coding Standard</td>
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<tr>
<th>Missile Course Deviation</th>
<th>Smart Appliances</th>
<th>Autonomous Underwater Vehicle</th>
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<td>Motion Tracking Device</td>
<td>“Universal” Credit Card</td>
<td>Secure Data Transfer System</td>
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<td>Platform for Media Riche Lecture Delivery</td>
<td>Digital Fingerprint Scanner</td>
<td>Web-based Information Tracker</td>
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<td>Real-time Multimedia Steaming System w/ advanced compression &amp; steganography algorithms over wireless channels</td>
<td>Digital Player Piano</td>
<td>Digital Video Surveillance System</td>
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<tr>
<td>Automobile Black Box</td>
<td>LED Learners Guitar</td>
<td>Media Pad</td>
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<tr>
<td>GPS tracking for RF transceivers</td>
<td>Modular LED Display</td>
<td>Electronic Caddy</td>
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# 2003 Projects

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<tr>
<th>Wireless Biomedical Sensor</th>
<th>Trans-verbal-ator</th>
<th>Intelligent Cellular Telephone Docking Station</th>
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<td>Environment Aware GPS</td>
<td>GameBoy TV Tuner</td>
<td>Parking Assistant</td>
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<td>Mobile MP3 Player</td>
<td>DBNS Filters</td>
<td>Autonomous Underwater Vehicle</td>
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<td>Real-time Inventory using RFID</td>
<td>Intelligent SMS Ordering System</td>
<td>FLASH Video Game System</td>
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<td>Thumb-thing</td>
<td>Hexaphonic Digital Mixer</td>
<td>Programmable Sculpture</td>
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<td>Software Defined Radio</td>
<td>Bluebird</td>
<td>Vehi-Track</td>
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<td>Automatic Mailbox Notification System</td>
<td>Network Bandwidth Monitor</td>
<td>Spectrum Analyzer</td>
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<td>Solid State Hard Drive</td>
<td>Voice Activated Remote Control</td>
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<tr>
<td>GPS Mass-Transit Tracker</td>
<td>Smart FRANN – Face Recognition using Artificial Neural Networks</td>
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