ECE496 Design Project
Course Seminar

Thursday, Sept. 10, 2009

Outline

Tonight
- Course Overview and Deliverables (Phang)
- An introduction to "Real-World Engineering" (Gillett)
- Preparing Your Project Proposal Drafts (Weiss)

Next Thursday, Sept. 17th, 7-8PM, MC102
- Question/answer session with administrators

ECE496 Team

1. Khoman Phang
2. Phil Anderson
3. Bruno Korst
4. Hans Kunov
5. Hamid Timorabadi
6. John Taglione*
7. Ross Gillett*
Your supervisor goes here!

ECE496 Team (cont.)

Kelly Chan
(Registration)
Mike Mehramiz
(Design Centre)
Peter Weiss et al
(Communications Centre)

*Industrial Administrator with ECE backup
ECE496 Goals

A capstone design project for ECE students to
1. **Integrate** their technical knowledge acquired through their undergraduate education
2. Effectively **communicate** their ideas and work
3. Develop team work and project management skills

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**ECE496: An Introduction to "Real World Engineering"**

Ross Gillett, M. Eng, P. Eng
September 2009

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**Agenda**

- What is Engineering?
- ECE 496 is important!!!
- Example of a Project
- Summary
What is Engineering?

- Science/Math
  - "creating knowledge":
    - Matrix mathematics
    - Electromagnetic Forces
    - Material properties
    - Heat Transfer
    - Tribology
    - Circuit theory
- Engineering
  - "creation using knowledge":
    - The Canadarm2

ECE 496 is important!!!

ECE496 = "Real World" engineering:
- ECE 496 teaches how to direct your skills toward achieving an engineering goal
  - Teamwork
  - Project planning, tracking
  - Technical and business communication
  - Risk management
  - System design process (to a limited extent)

Teamwork

Most (all) great "engineering feats" were accomplished by large teams of people.

Why was teamwork essential?
- There are not enough hours in one lifetime

My Current Project

Team: More than 20 people over 3.5 years (i.e. approximately 60 person-years)

NEOSSat: 75 kg Microsatellite to launch in 2010
- 80 kg Microsatellite to launch in 2011
Teamwork in **Your Project**

**Complex Design by Multiple Individuals**
(like your project!)
- Requires a team to complete the job within the school year

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**Project Planning/Tracking**

- **Perform Weekly Lawn Maintenance**
  - Cut Grass
  - Cut front lawn
  - Cut back lawn
  - Cut sides
  - Trim Edges
  - Trim property boundaries
  - Trim around garden
  - Trim around trees
  - Trim Bushes
  - Prune side hedges
  - Prune back hedge

**Case 1: One person does Lawn Maintenance**

No Teamwork

**Case 2: Two people do the same, each with their own equipment**

A team of two: [By adding team members, the project progresses faster]

**Case 3: Three people do the same but can't 'Trim' until the grass is cut (a logical dependency)**

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**Technical/Business Communication**

- All engineers and engineering companies:
  - Create proposals and project summaries
  - Conduct design reviews
  - Report progress to customers (Progress reports)
  - Present project overviews to clients, conferences and management
  - Seminars and/or posters
  - Give project demonstrations

*ie All of the activities in ECE496*

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Risk Management

• How many of you:
  – Bring more than one pen/pencil to an exam?
  – Back up important files from your computer to a CD/DVD?
  – Leave earlier for a 9AM exam than a 9AM lecture?
  – Drive a car with a spare tire? Replaced a spare tire?
  – Will not base your project's success solely on obtaining obscure components with uncertain delivery timelines?

• Then you have considered risk


System Design Process

• A process for efficient team-based design
  Goal → Use Cases → System Requirements → Component Requirements → Detailed Design → Verification

• The "Goal" is the top level (single sentence)
• The most famous "Goal" statement in history:
  "... I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to the earth".

  U.S. President J.F. Kennedy, 25 May 1961


System Design Process
(Aerospace nomenclature shown)

ECE 496 is Narrower

Why follow a Design Process?

Suppose a team of sculptors work together on a sculpture, each doing a separate part ....


Project Example using Requirement-Driven Design

Goal: Amplify the specified input signal, with large amounts of harmonic distortion, to drive 50Watts rms into an 8-ohm speaker

Input Signal Specification:
Approx 80-150 Vrms signal, 40-10,000 Hz, 10kOhm output impedance

Example: Final Design

- James' circuit
- David's circuit
- Susan's circuit

Summary

- You undergraduate theory forms the foundation of analysis / technical implementation – this is vital
- ECE496 focuses on organizing this knowledge for successful Engineering projects
  - Teamwork
  - Project planning and tracking
  - Design with Requirements
  - Technical and Business Communication
- These skills are highly valued in industry

ECE496 Milestones & Deliverables

<table>
<thead>
<tr>
<th>Start</th>
<th>Decide What you must Do</th>
<th>Do It</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept</td>
<td>Project Proposal (draft A)</td>
<td>Design Review</td>
<td>Final Report</td>
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<tr>
<td>Oct</td>
<td>Project Proposal (draft B to ECC) &amp; Draft A feedback</td>
<td></td>
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<tr>
<td>Nov</td>
<td>Project Proposal (final draft)</td>
<td>Individual Progress Report</td>
<td>Design Fair</td>
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<tr>
<td>Dec</td>
<td>Design Review meeting</td>
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<tr>
<td>Jan</td>
<td>Oral Presentations (tutorials)</td>
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<tr>
<td>Feb</td>
<td>Final Report</td>
<td></td>
<td></td>
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<tr>
<td>Mar</td>
<td>Design Fair</td>
<td></td>
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<td>Apr</td>
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ECE496 Deliverable Weighting

- Fall: 15% Project Proposal, 8% Design Review, 17% Individual Progress Report, 10% Oral Report
- Spring: 30% Final Report, 20% Design Fair

START Design
MIDDLE Produce
END Wrap Up
Your Final Report: A Living Document

- Evolving your final report from the start

<table>
<thead>
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<th>Section</th>
<th>Design Review</th>
<th>Progress Report</th>
<th>Design Fair</th>
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<tbody>
<tr>
<td>Project Description</td>
<td>Draft A</td>
<td>Draft B</td>
<td>final draft</td>
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<tr>
<td>Background and Motivation</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>Project Goal</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>Project Requirements</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Validation and Acceptance Tests</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tbody>
</table>

- Technical Design
  - Possible Solutions and Design Alternatives
  - System design overview
  - Module-level descriptions
  - Assessment of Proposed Design

- Work Plan
  - Work breakdown structure (WBS)
  - Gantt chart
  - Financial plan
  - Feasibility Assessment (resources, risks)

- Testing and Verification
  - Module-level test results
  - System-level test results

Support Resources

- Your supervisor
- Your administrator
- Friends of Design (watch for future meetings)
- Training workshops (watch for announcements)
- ECE496 Wiki & Blackboard discussion board
- The Supervisor’s Almanac
- The Design Centre (SFB520)
- Funding: OCE Connections and Design Project Fund
- Website & menu: Blackboard
- Books
  - P. Anderson, ECE298 System Design Course Notes
    - Available on ECE496 website
    - In Eng. Library (5 copies on 1day short term loan)
    - Sold at U.T. Bookstore

The ECE496 Wiki

- Use the discussion board to provide and suggest content

Working Together

- The ‘expert client’
- Defining the problem
- Getting the technical details ‘right’
- Marking consistency
- Engineering design & project planning
- Effective technical communication
Supervisor’s Almanac

- Help your supervisor by keeping on track

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Funding Support

- Students contribute up to $100 each
- Other sources of funding and resources include:
  - The ECE Department Design Project Fund. Students apply for this funding around the time of the Design Review.
  - Supervisors who contribute out of their own funds, particularly where the student projects will aid their research.
  - Industrial sponsors
  - Matching funding from the University and/or Ontario Centres of Excellence (OCE) through the OCE Connections Initiative

Mark Normalization

- Mark normalization ensures mark consistency across sections
- Your marks can go up or down (slightly)
- Marks heavily weighted towards final deliverables
- Don’t overemphasize marks - focus on making a strong impression with your supervisor and administrator
Awards

- ALOHA Award ($10,000)
- Gordon E. Slemon Design Award ($1k)
- Centennial Thesis Awards (2)

Many students get jobs based on their project!

Students Not On The List

Registered students will be assigned a section & administrator next week.

You need to register properly with Kelly Chan or you won’t be marked, etc. etc.

This is NOT our responsibility, it is YOURS.

If you know you are not registered and are not ready to register, come and see me at the end of the evening.

Reminder to students (1 of 3)

- First draft of Project Proposal due Tue. Sept. 22nd at 3pm sharp in drop off boxes across from Design Centre (SFB520). Softcopies submitted through your ECF account (make sure you can log in!)
- Keep current your email UofT address on ROSI and check it regularly
- Must petition if you hand in a deliverable late or if you fail to appear for an oral presentation (need medical certificate in the event of sickness)
- Try to avoid issues with intellectual property (IP) by keeping your profitable ideas out of ECE496
- Projects involving testing on animals or humans require an ethics review

Reminder to students (2 of 3)

- Self-manage. It is easy to “put off” work that has no deadline, but this catches up with you.
- Don’t use the time you should be allocating to the course to do other courses
- Don’t ignore other courses to do more work in this one
- Watch for long delivery times, long processes...
- Look ahead to the design fair & final report.
Reminder to students (3 of 3)

- Marks are NOT for deliverables alone. Supervisor will assign 50% based on his/her evaluation of your work, including biggest chunk of the “final report” mark.
- Keep notes. Keep a notebook.
- Do the work, then report on it. Think about what you are reporting and make the report appropriate.
- Writing well helps, but you are COMMUNICATING about your project. Review the feedback. More later …
- Have regular, focused meetings with your supervisor.
- You, not your supervisor and not your administrator, are responsible for your project!

Questions……

- time for questions at the end
- Q&A period next week

Given those, any “quick answer” questions before we move on?

Proposal Draft meetings

- Drafts are due in hard copy: Tuesday, September 29 by 3 p.m.
- At Engineering Communication Program, Sandford Fleming B670
- BEFORE you hand in your draft, sign up for a meeting when whole group can attend
- Write down meeting letter and time, e.g. Group L, Tuesday October 5, 3:30 p.m. on the draft and in your engineering notebook
### Purpose of meetings

- We will ask questions to help you clarify your ideas
- We will give you feedback to help the revision and editing process
- We will not correct errors though we will identify Unacceptable Level of Error (ULoE)

### Unacceptable Level of Error (ULoE)

- Either word use, sentence structure or logic errors that prevent the reader from ascertaining the information being given in ONE FAST READING!
- If the reader has to re-read a sentence two or more times in order to “get it,” then the administrator may choose not to grade it until it has been rewritten with the assistance of an ECP tutor

### What is most difficult to write:

- The main *idea*
  - Project purpose
  - How project fits in the world, past present and future
  - Measurable objectives by which project will be realized

### Provide only tangible, accurate, supported information

- Readers are busy
- No one is going to pay to tell them something they already know – so forget general knowledge as a source
- If you can’t prove it, don’t write it
### Example of what not to write

- Everyone today is desiring for more smaller digital audio devices with shrinking capacity.

### What does it help to correct the errors?

- Everyone today wants a smaller digital audio device with more capacity.

### Revision

- This project addresses a perceived marketing opportunity for tiny digital audio devices with greater capacity.
Support

- This project addresses a perceived marketing opportunity for tiny digital audio devices with greater capacity.
- List current devices, their sizes and capacities
- Discuss the size of their market
- Discuss current research into methods for reducing size and increasing capacity

Revising versus Editing

- Revising considers the central idea and document as a whole
- Editing is primarily concerned with the clarity of expression
- Final draft is a revised and edited version of drafts A & B

Revising

- May delete, add or shift whole sections
- Ensures that the document contains the appropriate material
- Ensures material is in the appropriate section
- Ensures connections between sections are clear and logical

Editing

- Ensures the relationships between ideas are explicit
- Ensures relationships are reinforced by section and paragraph structure
- Ensures relationships between sentences or points in lists
Proofreading

- Last thing you do
- Primarily concerned with error
- Hit Parade of Errors
  http://www.writing.utoronto.ca/advice/style-and-editing/hit-parade-of-errors
- 15 errors = 15 passes over document

Resources

Guides:
- Design and Writing Reference Texts
- Online Dictionary and Thesaurus
- Writing at the University of Toronto
  http://www.utoronto.ca/writing/
- Engineering Communication Centre
  http://www.engineering.utoronto.ca/about/programs/communication/booking.htm

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Upcoming Events

- Thurs. Sept. 17th  Q&A session here at 7pm
- Tue. Sept. 22nd  Draft A due
- Tue. Sept. 29th  Draft B due
- Thurs. Oct. 1st  Draft A returned during Meet your Administrator Night