

Senior Design Project¹

CS489

Spring 2003

Class Time: 3:30 PM — 4:20 PM M.W.F.

Class Room: Ferguson 112

Instructor: Hong Jiang

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Teaching Assistant: Jedidiah Pedersen

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Office Hours (Jiang): 2:30 PM — 3:25 PM M.W.F.

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Office Hours (Jed): 9:30 AM — 11:00 AM M.W.F.

Office: Ferguson 17A

Description:

489. Senior Design Project (3 cr) *Prereq: ELEC 362 and 476; CSCE 430 and 488. CSCE 488 and 489 must be taken in sequence. CSCE 488 must be taken first and in the term previous to registering for CSCE 489. Permission must be obtained to take the courses out of sequence.*

CSCE 489 will use the team approach. All teams are given a broadly defined design problem containing aspects of both software and hardware design. Projects are sufficient in complexity as to require team members to partition and coordinate their efforts for successful completion. Written technical reports and oral presentations are required.

Course Objectives:

To gain hands-on experience in a significant design project involving technological competence, open-ended problem solving, teamwork, and both written and oral communication skills.

Prerequisite by Topic:

1. Mastery of: Computer Architecture, Computer Programming, Digital System Design, and Logic Design.
2. Familiarity with: professional writing and speaking styles, conventional word-processors, and the particular design tools and technologies needed for successful completion of the project.
3. Exposure to: the concepts and principles of professional ethics, and team dynamics.

Topics to be covered:

Varies from project to project.

Lectures:

We will adhere to the published lecture schedule for only a couple of weeks. After that each group will meet weekly with the instructor for progress updates and asking questions. While these meetings will typically be brief, attendance is mandatory. Each group will give three oral presentations, appropriately spaced during the semester, in lieu of the standard progress meeting.

¹This syllabus is adapted from Sharad Seth's CSCE489 syllabus for the Spring'2001 semester.

Attendance:

A team's progress is made possible by the dedication and tangible contribution of each of its members. You should contact your team members and the instructor as soon as possible if you have a legitimate reason for missing any work (e.g. illness or death in the family). The sooner the better, so that appropriate adjustment to requirement and/or deadline can be made.

Textbook/References:

While there is no official textbook required, you may find the following books very useful. In particular, it is recommended that each group (team) should have at least one copy each of the first book.

- *Robotic Explorations – A Hands-On Introduction to Engineering*, by Fred G. Martin, Prentice-Hall, Inc., 2001. Available in the bookstore.
- *Computational Principles of Mobile Robotics*, by Gregory Dudek and Michael Jenkin, Cambridge University Press, 2000. Available in the book store.
- *The Little, Brown Essential Handbook for Writers*, 3rd ed., by Jane Aaron. Available at amazon.com.
- *The Unofficial Guide to LEGO Mindstorms Robots*, by Jonathan Knudsen. Available at amazon.com.
- The Handy Board web page (<http://handy-board.com>). Includes manuals, FAQ, hardware/software references, community links, etc.
- “Ideal and real systems: A study of notions of control in undergraduates who design robots,” by Fred Martin. In *Construction in Practice: Designing, Thinking, and Learning in a Digital World* (Yasmin Kafai and Mitchel Resnick, eds.), 1996.

Class Scenario:

- **Design Project:** A major corporation in the computer field is seeking a sub-contractor to design and build a particular subsystem for a larger system. Each team of students works for a different company, and each company wants to be the chosen sub-contractor. Therefore, the teams are in competition with each other.

You will be given a Request for Proposals (RFP) stating the subsystem requirements. You will also be provided with a set of “in-house” hardware and software tools. Your task is to perform an initial design of the subsystem in question, construct an engineering prototype, test it, and make a convincing presentation to the customer. Remember, you have competitors!

- **Instructor's Role:** The instructor will play the part of your “Project Manager”. As such, he is not directly involved in the design or implementation of the project. Rather, his role is managerial and advisory. You may assume that your project manager came up through the engineering ranks and thus is (or was) a competent computer engineer. However, in the last few years, his time

has been consumed more by management duties than by technical duties, so he may be a bit “rusty”. Furthermore, your project manager has several other projects also under his supervision, so he cannot give complete attention to yours.

Other faculty members may be asked to play the part of “Customer Representatives” at one or more points during the semester. Their goal will be to protect the best interests of their own company. They should be considered intelligent and well-versed in the subsystem specification.

- **Academic Honesty:** Each team is to work independently from the other teams. Remember, *you are competitors!* Any attempt at sabotage, industrial espionage, or theft of intellectual property will be grounds for the immediate awarding of an “F” for the course and/or the filing of formal charges with the Judicial Affairs office, in accordance to the *Academic Integrity Policy in the Department of Computer Science and Engineering* officially adopted on May 3, 2001 (for details refer to <http://www.cse.unl.edu/StudentResources/AcademicIntegrity.php3>). Similarly, you may not plagiarize designs from the published literature. However, borrowing and adapting *ideas* from the literature *is permitted* as long as you properly credit the originators of those ideas.

Conversely, you are responsible to safeguard your own “Proprietary Information” so it does not become “public domain” through carelessness. Thus no other teams will be present for the first two reports. However, all teams will be present for the final report.

Grading Policies:

- **General:** There will be three project reports and *no* homework. Each project report will have both a *Written* component and an *Oral* component. Each report must be a “stand-alone” report that does *not* assume familiarity with earlier reports. In addition, during the entire semester each student must keep a detailed *design notebook* containing an individual record of his/her work in this class.
- **Expectations and Weights:** The graded components and their weights are listed below. The grade for *each* project report will be based
 - 50% on the technical merit of the design²,
 - 25% on the quality and clarity of the written component, and
 - 25% on the quality and clarity of the oral component.
- **Prerequisite Test (5%)** – A take-home test covering the broad range of prerequisite knowledge. Due the third week of class.

²Remember: a good report cannot disguise a bad design, but a bad report often disguises a good design.

- **Attendance at Meetings (5%)** – Each week the *entire* team will attend a meeting with the project manager. At this meeting, the team will summarize their progress so far and ask questions on the project. In addition, the team will submit a 1-2 page written summary on last week's goals, how well these goals were met, and what next week's goals are. In addition, an estimate of how much time each of you spent on the project that week is included in the summary. (These estimates will not affect your grade; the project manager understands that you have other commitments during the semester and expects the amount of time spent to fluctuate.) Failure to arrive on time to a scheduled meeting without a valid excuse or to submit a summary will count against this portion of your grade.
- **Design Notebook(10%)** – This is like a log book or journal in which you will record your progress through the course. It will be the resource you will use to write your portion of the periodic progress reports as described further on. The following are specific requirements which must be met by your design notebook³.
 - One substantive, *dated* entry must be made per week describing the progress made during that week. Additional entries should be made to summarize each group meeting and as necessary to document work during more intensive periods of activity.
 - The notebook must be neat but should not consume an enormous amount of your time. Write and sketch *legibly* using a pencil (for ease corrections); don't waste time trying for a publication-quality output.
 - Design ideas should be recorded in the notebook *as they occur*.
 - Detailed written descriptions must be made of *all* mechanical designs, with *labeled* sketches and photos as necessary.
 - Results of testing and subsequent revisions of designs must be included.
 - A written overview of all algorithms (e.g. written summaries, pseudo-code, or flowcharts) and complete, fully-commented listings for all code must be included.
 - Any sensor calibration data which are taken must be recorded.
- **Progress Report 1: Getting Started (20%)** – Approximately the fourth to fifth week of class, each team will report to the Project Manager their progress on establishing the fundamental understanding necessary for successful completion of the project. The following are the specific requirements for this report:
 - Familiarization with the Interactive C programming, mechanical construction using Legos, and sensors' calibration and reliability.
 - Implementation and testing of the basic autonomous robot functions.
- **Progress Report 2: First Complete Design (20%)** – Approximately the tenth week of class, each team will present to the Project Manager a report describing your *first complete design*. Each team will also be asked to do a separate

³Adapted from <http://www.eecs.cwru.edu/courses/lego375/cgen.html/>, January 4, 2001.

demonstration of their design. The written report should thoroughly document the design, implementation, and testing. Document the design choices made, false starts and difficulties encountered, and shortcomings of the design that would be removed in the final design.

- **Progress Report 3: Final Proposal (25%)** – During the last week of class (a.k.a dead week⁴) each team will present to the Project Manager, the Customer Representatives, and the rest of the class a final proposal, detailing the design, testing, and performance of the project. A demonstration may also be required. Note that even if the design is not complete, a *detailed test* (e.g. functional simulation of hardware, demonstration of software) of all implementation subsystems is expected. The final proposal must also include a bid to the customer of the cost per unit of your proposed product (which might vary depending on the number of units ordered), including a summary of development costs, parts, and mark-up. You are to submit *two* complete copies of your final proposal: one with your team's and participants' names on it and one that has all team and personal names removed.
- **Team Contest and Demonstration (15%)** – Two contests, a preliminary one (5%) and a final one (10%), will be held.
 - Preliminary Contest: to be held at around the time of the 2nd progress report (first complete design);
 - Final Contest: to be held during the CET Engineering Week;

Finally, each time your team submits its progress report, you will *independently* submit your design notebook and a review of every member of your team, *including yourself*. In this review (not exceeding one typed page total for all members), describe what parts of the project each member worked on and how well you feel that member worked with the rest of the team. (Remember to review yourself as well.) Also discuss how well the entire team worked together. You should be completely honest and candid in your review. Do *not* share your design notebook and review with anyone else. This review will not in any way affect your grade.

In summary, 20% of your grade (comprising of the prerequisite test, attendance, and design notebook) will be individual and the remaining 80% of the grade will be shared with other members of your team.

Finally, note that *every member of your team gets the same grade on each written and oral report*. Thus if you feel that someone in your group is not contributing as much as the rest of the group, you should first try to resolve the issue on your own. If that proves unsuccessful, then come see the Project Manager about it privately (i.e. not in front of the accused party).

⁴In accordance with the UNL Dead Week Policy, you have now been informed in writing of the nature and scope of this report prior to the eighth week of classes.