CSCE 496/896: Embedded Systems Design and Implementation

Monday, Wednesday & Friday 12:30 - 1:20 pm
Military and Naval Bldg, Room B6

1 Contact Infomation

Instructor: Dr. Witawas Srisa-an
123E Avery Hall
Tel: 472-5004
Email: witty@cse.unl.edu
Hours: Monday & Wednesday 10:00 am - 11:00 am.
Make appointment to meet outside of these hours. My real-time schedule is on-line.

Teaching Assistant:
None

2 Overview

This course is designed to address the current topics in embedded systems design, implementation, and deployment. As of now, embedded computers are the fastest growing area of computing. Over ninety percents of all processors are used in embedded applications, which include "Anytime-Anywhere" computing (e.g. portable phones, Personal Digital Assistants), digital cable decoding, sensors, and micro-controllers for mechanical, chemical, biological processes, etc. Thus, the focus of this course will be on current practices adopted by developers and efforts to advance the field of embedded computing. We tentatively propose that the focus of this class be on the following topics:

- System-On-a-Chip (SOC)and System-On-a-Programmable-Chip (SOPC)
- Low power design
- Application Specific Integrated Circuits (ASICs)
- Rapid Prototyping using Field Programmable Gate Arrays (FPGAs)
- High-performance embedded processors and systems
- Hardware/Software Codesign

We will address these topics from theoretical and practical perspectives. The major hands-on exercises will include ASIC design, hardware/software interface, application development in embedded systems, tools for performance and power analysis, and advanced processor architectures for embedded systems. The lecture materials will be based on a combination of textbooks, technical manuals, and research publications. The participants will also independently examine current practices in embedded systems design.

3 Course Organization

This course is designed to provide students with hands-on experience in embedded systems design. Thus, the lecture will be broken down into several sub-topics. In each sub-topic, there is a homework and/or a lab assignment that is/are designed to provide a good representation of the state-of-the practice. Throughout the semester, we will be working with several tools commonly used to design embedded systems. Some of these tools include GNU profiler, Altera Quartus and SOPC builder, Stretch IDE, and Microsoft Platform Builder. Students are expected to complete several hands-on homework assignments and lab exercises (at least 4). In addition, there will be one hands-on midterm exam and one team project. The instructor will provide students with several options in choosing the project.

4 Materials

We have no official textbooks due to the diverse nature of this course. However, I have provide two recommended optional texts and several documents that will be distributed in class. The two optional textbooks are:

- *Computers as Components: Principles of Embedded Computing System Design*, by Wayne Wolf, Morgan Kaufmann Publishers, 2001 (OPTIONAL TEXT, available from the bookstore).
- *Programming Microsoft Windows CE, Second Edition*, by Doug Boling, Microsoft Press, 2003 (OPTIONAL TEXT but may be useful for the projects).

I will also provide several reference manuals and on-line tutorials provided by the tools vendors as part of the reading as well as project assignments. You should also browse through our on-line help and download course notes prior to each week. On-line help page is at:

www.cse.unl.edu/~witty/embedded/howto.html

Weekly lecture notes can be downloaded at:

www.cse.unl.edu/~witty/embedded/materials.html

Assignments can be found at:

www.cse.unl.edu/~witty/embedded/assignments.html

5 Prerequisite

CSCE 310 (or background in data structures and algorithm) and familiarity with advanced concepts in operating system, programming language, computer architecture, and object-oriented programming is useful but not required.

6 Credit Information

Upon the completion of this course, students can earn 3 credits.

- For undergraduates, this course satisfies the hardware track for Computer Science majors and design implementation track for Computer Engineering majors.
- For graduate students, this course satisfies the systems track.

7 Grading

Your final grade will be composed of:

1. Class participation (5%) - If you are active in class, active on the forum, or active outside of class, you can earn up to 5 points. Typically, it is difficult to clearly define the criteria for giving out points in class participation. In the past, I've used the following criteria to assign points:
    - common beginning—everyone begins the semester with three points. So if you show up to class every time but never participate in any activities, you would stay at three points.
    - familiarity with the students—if you are active in forum participation, make frequent visit during office hours, or/and actively participate in the classroom, you have earned 1 or 2 positive points.
    - absence — if you are not present during random attendance check, not picking up graded material, sleeping in class (trust me, I remember), you have earned 1 or 2 negative points.

- different ending—you final score is based on the sum/difference of positive/negative points.

2. Homework and Lab Assignments (40%) - Lab 20% and Homework 20%. The distribution within this category is still tentative.
3. Examination (20%) - Will occur around week 10. It will be a hardware design challenge.
4. Final project and presentation (35%) - during the dead or final week

Grading scale will be

A+ = 98 - 100+
A = 94 - 97.99
A- = 90 - 93.99
B+ = 87 - 89.99
B = 83 - 86.99
B- = 80 - 82.99
C+ = 77- 79.99
C = 73 - 76.99
C- = 70 - 72.99
D-, D, D+ = 60 - 69.99
F = Below 60

Notice: The same scale applies for both undergraduate and graduate students.

Note: Automatic two-business day extension will be granted in exchange for 30% reduction in that assignment score. To take this option, you need to send me an e-mail specifying that you will be late within 24 hours **AFTER** the deadline. I will not accept late assignment after the extended period. This precisely means that you will get **NO** credit for your work.

8 Ground Rules

Please note that by staying on the course you are abiding to the rules and regulations described below. These are non negotiable.

1. All work submitted has to be your own work. Cheating of any form (copying from someone (or other groups) allowing someone to copy from you (or your group), presenting someone else's work as your own either partially or fully) will guarantee FAILURE in this course. In addition, your action will be reported to the Dept. Chairman. We **encourage** you to collaborate with your classmates on issues such as clarifying the problem statements, discussing potential solutions, discussing related tools and features needed for the assignments.

2. Project reports are due on a day we have a class up until the end of the lecture. Anything after that is considered late. If you decide to use the mailboxes in the CSE department then we are not liable if they are lost or stolen from the mailbox. It is your responsibility to get your report submitted. If you fail to do so you will receive no credit for it. Unless specified, your work should be submitted through *hand-in*.

3. For project assignments, instructions will be given accordingly.

4. No assignment will be accepted after the two-day extended period.

5. For the purpose of this course, you will have to download and install certain software packages. Help pages will be provided but you are expected to perform the task yourselves.

6. You are expected to be comfortable with the prerequisite material. If you feel you are not, it is your responsibility to revise and prepare accordingly.

9 Special Needs

We will try to accommodate any student with a disability. Please contact the instructor as soon as possible if you need special accommodations.