AME 3623: Embedded Real-Time Systems (Spring 2011)

This course provides an introduction to integrated hardware/software solutions in computational systems with sensing and actuation. Today, devices including microwave ovens, VCRs, high-speed trains, automobiles, cochlear implants, and artificial limbs routinely employ a variety of embedded microcontrollers for process control. We will explore the concepts fundamental to these applications while designing and building our own robot controllers.

By the end of this course, you should be able to:

- design and implement embedded circuits involving microcontrollers, sensors, and actuators,
- design, program and debug embedded sensing and control software,
- work in collaborative teams to solve system design and implementation problems, and
- communicate in both oral and written forms with team members.

This is a very hands-on class: every student will be involved in the design, implementation, and programming for the laboratory exercises. Note that this component of the class will involve a non-trivial amount of time; students should plan their schedules accordingly.

Topics will include:

- digital logic and Boolean Algebra,
- sequential logic,
- number representations and arithmetic,
- basic microprocessor design,
- embedded system development environments,
- processor input/output implementations and electronic interfaces (including analog-to-digital translation),
- serial protocols and implementation,
- controller design and implementation,
- basics of operating systems (including concurrency and real-time issues), and
- issues in embedded hardware design and debugging.
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Lecture Time: T/Th 9:00-10:15
Lecture Location: Carson Engineering 123

Textbooks: as there is not a comprehensive textbook available, we will be drawing our readings from the net and from part of one textbook. This textbook and several optional supplementary textbooks are listed below:

- (optional) **Embedded C Programming and the Atmel AVR**, Richard H. Barnett, Sarah Cox, Larry O'Cull (2003), Thomson/Delmar Learning, ISBN: 1401812066. The first half of the book is a good review of C (the latter half discusses a compiler that we are not using). Available at Bizzell Library. Some excerpts available on D2L.
- (optional) **Arduino microcontroller processing for everyone!** Steven F. Barrett (2010), Morgan and Claypool. General overview (and some examples) of the Arduino platform. Electronic copies: part 1 and part 2 (must be on the OU subnet)

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**Important Pages**

- Course Syllabus
- Semester Schedule
- Desire to Learn
- Lecture Notes
- Atmel HOWTO

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