

SE-352

Embedded Software

Spring 2009

Location: HH B-1

Time: M/W 11:30 AM - 12.45 PM

Instructor

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- Office Hours: M/W 10:00-11:00. Other time by appointment

Course Objectives

This introductory course to embedded and real-time systems familiarizes students with basic principles used in understanding and describing software systems that are a part of larger software systems and whose functional correctness must be delivered in a timely manner. The objectives of this course is to understand fundamentals of embedded and real-time software technology, to get familiar with a broad view of issues in real-time software development, to be able to distinguish between common and specific characteristics of real-time systems, to acquire experience in specification of small (to be embedded) software systems; to get familiar with the mechanisms for interprocess communication and synchronization and their implementation techniques, to get exposed in the use of structured and object-oriented methods to specify and design real-time and embedded software, and to get familiar with commercially available environments and tools for development of embedded and real-time software systems.

Textbook

No textbook. Course material will be distributed in the class.

Laboratory

Equipment to be used in conjunction with this course consists of: personal computer workstations hosting Tornado integrated software tool for development of embedded and real-time software, and Motorola single board computers hosting the VxWorks real-time operating system. Application software is developed, debugged, and tested in the Tornado development environment. A detailed behavior of the application program can be studied by collecting pertinent data about program run using the Wind View tool, a part of the Tornado development environment. The developed application program can be run in the Tornado-simulated environment VxSim, or can be downloaded to the target hardware supported by Motorola single board computers.

Laboratory equipment manuals can be found in the lab or on the Web. All laboratory personal computer workstations, hosting Tornado, have on-line access to Tornado manuals from the Wind River Company at <http://www.wrs.com>. The following hardcopy manuals provide additional information about how to use the laboratory equipment:

- Tornado User's Guide, Wind River Systems, 1999
- VxWorks Programmer's Guide - 5.4, Wind River Systems, 1999
- VxWorks Reference Manual - 5.5, Wind River Systems, 1999
- Tornado BSP Developer's Kit for VxWorks, Wind River Systems, 1999

Course Work

There will be six lab assignments, a midterm exam and a final exam.

The laboratory assignments are targeted to gain hands-on experience in designing and implementing small-scale embedded and real-time software featuring: multitasking, message queuing for inter-task communication, task synchronization using semaphores, exception handling, and task execution timing.

All software assignments are to be developed in the C/C++ programming language and tested on the virtual machine provided by the real-time operating environment VxWorks. Thus, in order to demonstrate the assignments in the lab, active knowledge of Tornado development environment and VxWorks operating system is necessary.

Grading

Lab Assignments	60%
Midterm	20%
Final exam	20%

Class Participation

Class participation is strongly recommended. If you miss a class, it is your responsibility to find out what is covered and what announcements are made in the class.

Withdrawal

Last date to withdraw with automatic assignment of a "W" grade: Monday, March 30, 2009.

Special Accommodations

Students with disabilities who need special accommodations for this class are encouraged to meet with the instructor or the appropriate disability service provider on campus as soon as possible. In order to receive accommodations, students must be registered with the appropriate disability service provider as set forth in the student handbook and must follow the University procedure for self-disclosure, which is stated in the University Guide to Services and Accommodations for Students with Disabilities. Students will not be afforded special accommodations for academic work done prior to completion of the documentation process with the appropriate disability service office.

Academic Honesty

Everything you turn in for grading must be your own work. Academic dishonesty subverts the University's mission and undermines the student's intellectual growth. Therefore, we will not

tolerate violations of the code of academic honesty. Penalties for such violations include suspension or dismissal and are elaborated upon in the Student Handbook.

Tentative Course Contents

- Introduction to Embedded and Real-Time Systems
- Real-Time System Reference Model
- Concurrent Programming
- VxWorks Real-Time Operating System
- Tornado: Integrated Real-Time Software Development Tool
- Multi-processes Synchronization and Communication
- Resource Control
- Real-Time Facilities
- Real-Time Scheduling
- Reliability and Fault Tolerance
- Lab Presentation