CS 4397 : Embedded Computer Systems

Syllabus: Fall, 2018

Please note: Please look at the course schedule and catalogue for information on withdrawals, incompletes, and academic honesty.

Instructor: Farokh B. Bastani

1. *Office hours:* Tuesday/Thursday, 11:30 a.m. - 12:30 p.m.
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Pre-requisite.

1. **CS 4348 (Operating Systems Concepts) or equivalent.**

Reading material.

1. Text/Recommended/Reference books:
   (a) Q. Li with C. Yao, *Real-Time Concepts for Embedded Systems*, CMP Books, 2003 or later.
   (b) J.W.S. Liu, *Real-Time Systems*, Prentice Hall, 2000 or later.
   (c) A.M.K. Cheng, *Real-Time Systems: Scheduling, Analysis, and Verification*, Wiley Interscience, 2002 or later.
2. On-line references, including conference and journal papers.

Catalogue Description.

1. Introduction to embedded computer applications and concepts;
2. Real-time operating systems and resource management;
3. Real-time scheduling and communication;
4. Sensor data acquisition, processing, and fusion;
5. Error handling, fault tolerance, and graceful degradation;
6. System performance analysis and optimization techniques; and
7. Project to develop and analyze a small embedded computer application.

Topics. The course will cover the following topics:

1. Overview of embedded applications and concepts with emphasis on the distinguishing characteristics of embedded systems and the constraints that they must satisfy.
2. Distinguishing features of embedded software development process, including host/target environments and linking and memory mapping requirements.
3. Real-time scheduling and schedulability analysis, including clock-driven and priority-driven scheduling.
4. Brief review of the features of real-time operating systems and how they differ from general purpose operating systems.
5. Fault tolerance and dependability assurance methods for embedded systems.
6. Resource management in real-time systems, including potential problems and their resolution as well as practical issues in building real-time systems.
7. Specification and design methods for real-time systems, including verification using Real-Time Logic, Mode Charts, and Time Petri Net specifications (if time permits).

There will be projects related to process-control or communication systems. These will use actual embedded systems devices, including TI 3200 Launchpads, TI RTOS, Analog Continuous or Standard Servo, and other embedded devices. The final project will be a group project.

Evaluation. Cheating, plagiarism, collusion, and falsifying academic records will not be tolerated and will result in an "F" grade on the course. The tests and the exam are open notes. However, you must not discuss the questions and/or answers with anyone else nor copy or look at anyone else's answers nor seek help with the tests or exam from anyone in any way.

There are no make-up dates for missed examinations. Late assignments will not be accepted.

1. Three examinations: 50% of the overall grade.
2. Individual programming assignments: 20%. These will focus on embedded system design and development process and real-time scheduling.
3. Group project: 30%. The project will target an application in process-control systems or telecommunications. It will include design/implementation/analysis of a system and its documentation.