CSE 524 Realtime and Embedded Operating Systems May 2013

Course Description

Computers are embedded in countless real-world devices such as cell phones and remote controllers and in systems inside automobiles and aircrafts. These devices and systems are required to perform flawlessly and in real-time. The course covers principles, practices and state-of-the-art environments in embedded and real-time systems. Course modules are designed to provide an excellent working knowledge of applications, tools and environments in embedded systems area. The concepts taught will be illustrated using design and implementation of embedded systems and their device drivers. The delivery of courses will be interactive, each student working with examples as and when the instructor discusses them and demonstrates a concept. Topics covered will include:

- Introduction to realtime systems and embedded systems: design and implementation of simple realtime system; mutli-tasking, task loops; cyclic executives; design representation using state diagrams.
- C language foundations: program structure, basic elements, standard IO, pointers, memory management, dynamic memory, memory leaks, buffer overflow and best practices for realtime and embedded systems.
- Realtime kernel programming: vs application-level programming; unix-like system; device drivers: foundational concepts, design and implementation; Directory structure, separate compilation and make utility.
- Concurrency: process model and thread model for realizing concurrency; shared resources; semapahores; event-driven programming.
- Scheduling RTOS: priority scheduling; priority inversion problem and solutions; Priority inheritance. Schedulability, deadlines, deadline-based scheduling, rate monotonic scheduling. Table driven and function driven scheduling.
- Inter-process communication: files, pipes, messages; file tables and file pointers; Socket API and external communication.
- Application of the realtime and embedded systems concepts to automotive domain and introduction to AUTOSAR (Automotive Open System Architecture).

These concepts will be reinforced through C programming assignments using the Linux operating system. On completion of this course students will be able to (i) understand the components and working of a realtime and embedded operating systems, (ii) program devices using C and C-like programming language and (ii) design and implement various embedded operating system functions.

Course Information

Website:	http://www.cse.buffalo.edu/~bina/amrita/rtos
Instructor:	Bina Ramamurthy (bina@buffalo.edu)

Textbook and other material

The primary textbook for this course is: Real-Time Systems Development (Paperback) by Rob Williams

Paperback: 320 pages
Publisher: Butterworth-Heinemann (December 3, 2005)
ISBN-10: 0750664711
ISBN-13: 978-0750664714

Pre-requisites

The course and the lab work revolves around strong design, which you have all been exposed to since Programming/Computer Science I and II and digital systems knowledge.

Grading Distribution

Grades will consist of the following components:

Component (Quantity)	Percentage
Labs (2)	10%, 10%
Tests (2)	15%, 15%
Final Exam	50%

Point distribution guideline will be as follows:

Percentage	Letter Grade
95.00-100	A+
85.00-94.99	A
75.00-84.99	B+
65.00-74.99	B
55.00-64.99	C+
50.00-54.99	C
45.00-49.99	D
0-44.99	F

I reserve the right to alter component weighting or provide a "curve" on an assignment as warranted.

Miscellaneous

Please do not hesitate to talk to me, give me feedback about anything related to the course or the management of the course. You can talk to me after every lecture as well as through email.