14:332:435, Topics in Electrical & Computer Engineering

Subtitle: Programming for Embedded Systems

Monday and Wednesday, 5th period (3:20PM to 4:40PM) SEC-202

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index for Spring 2015 is 15320.
Instructor: Dr. Ben Firner , bfirner@eden.rutgers.edu
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Programming for Embedded Systems

Course Description

This course will teach the concepts and skills necessary to program embedded systems and build basic projects using a microcontroller. Topics will cover hardware level programming in C, timers, interrupts, digital and analog I/O, and memory management. This class will give students hands-on experience completing small hardware projects using an MSP430 Launchpad. Students will learn to solder basic circuits to use peripheral devices with the MSP430 during course projects. Students will find the topics of this course useful if they plan to use a microcontroller in their capstone design projects.

Pre-Requisites

14:332:252 (Programming Methodology I)

Pre-Requisite Topics

1. Knowledge of C or C++
2. Understanding of basic circuit design

Reference

MSP430 User's Guide

Topics in Order of Appearance

1. Programming without an OS
2. Hardware Architecture
3. Memory Organization
4. System Reset and Initialization
5. Digital I/O
6. Analog to Digital Conversion
7. Clocks and Timers
8. Interrupts
9. Comparators
10. Low Power Sleep Mode
11. Bus Communication: I^2C, SPI, and UART
12. Controlling peripheral devices

Student Assessment

Quizzes (10% of grade)

Exams (40% of grade)
Course Projects (50% of grade)

Course Objectives

As the size and cost of integrated circuits have decreased we have found more and more ways to use embedded systems, from simple items, such as MP3 players and wearable fitness bands, to safety-critical systems in cars and airplanes. When embedded systems are designed, the smallest and cheapest chip is often chosen so many fewer resources are available than when programming on a general-purpose PC. Programmers must also work without the benefit of an operating system to simplify interaction with hardware devices and peripherals.

Programming for embedded systems is a challenge because every task requires knowledge of many components of the system. At the same time, embedded programming is very rewarding because the programming has direct control over so many parts of the system. The goal of this course is to familiarize students with the concepts and practical skills required to successfully program embedded systems. After finishing the course, students should feel comfortable building their own projects using small microcontrollers such as the MSP430 from TI.