Introduction to Embedded Systems

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Introduction to computer organization: CPU, registers, buses, memory, I/O interfaces.
Number systems: arithmetic and information representation.
Assembly language programming: addressing techniques; arithmetic and logic operations, branching and looping, stack operations, procedure calls, parameter passing, interrupts.
C language programming: pointers, memory management, stack frames, interrupt processing.
Multi-threaded programming: preemptive and non-preemptive kernels; shared resources; scheduling.
Instrumentation: sensors, actuators, digital+analog I/O, motor drivers, encoders, interfaces

Prerequisite: COEN 012 or MATH 61. (4 units)
• COEN 010. Introduction to Programming
• COEN 011. Advanced Programming
• COEN 012. Abstract Data Types and Data Structures

Recommended Reading

Theory:
N. Wirth, Digital Circuit Design, Springer 1995

Practice:
J. Pardue, C Programming for Microcontrollers Featuring ATMEL's AVR Butterfly and the free WinAVR Compiler, SmileyMicros 2005
J. Morton, AVR – An Introductory Course, Elsevier/Newnes
Kernighan, Ritchie, The C Programming Language (or your C programming book of choice)

Contents

1. Introduction to Embedded Systems
2. CPU Design
3. Board Design
   A. Machine and Assembly Language
   C. Programming in C
4. Actuators
5. Control
6. Sensors
7. Image Processing
8. Embedded Software

• Embedded microprocessors and microcontrollers:
  – CPU functionality, function units, structured CPU design, embedded system design, interfacing and integration, reconfigurable computing.
• Instrumentation:
  – sensors, actuators, digital and analog I/O, motor drivers, shaft encoders, interface standards, protocols.
• Programming for embedded systems:
  – Assembly languages, C/C++ and interfacing with assembly languages, interrupt handling, timer interrupts, real-time systems, multi-threading, device drivers, programming techniques.
Marks

- To be finalized!
- Does everybody take the labs?
- Maybe:
  - Midterm 30%
  - Final exam 70%
  - No homework (besides labs)

Intranet

http://students.engr.scu.edu/~ctseng2/coen20/