Course Syllabus
ECE 625– Microprocessor Interfacing and Applications

Department: Electrical and Computer Engineering
Course Number: ECE 625
Course Title: Microprocessor Applications in Engineering
Credit Units: 3

Course Description
Various interfacing concepts and techniques are presented for Microprocessor Systems, to gather data and control peripheral devices. The topics include General-purpose Inputs/Outputs, Analog Inputs, Serial Communication Interfacing (SCI), Serial Peripheral Interfacing (SPI), Pulse Width Modulation (PWM), Inter-IC (I2C), Controller Area Networks (CAN), Real-time Operating Systems (RTOS), etc. Real-world design issues and applications such as classical and fuzzy control system applications are discussed. Methodical system design approaches are adopted to develop microcontroller-based embedded systems. Term projects involving both hardware and software design are required to solve a practical problem and incorporate elements from the lecture.

Prerequisite by Topic
Students should be familiar with the following topics:
1. Digital logic, binary number systems and arithmetic, and computer operation (ECE 320).
2. Assembly language programming, basics of C programming, microprocessor architecture, functional modules of microcontrollers such as digital I/O, analog to digital converter, serial I/O, and timer systems (ECE 425).

While not prerequisites, there will a discussion of the following areas as they apply to microprocessor and microcontroller applications: classical and/or fuzzy control systems, digital signal processing, and basic numerical methods. It would be helpful if the student had some familiarity with some or all of these topics.

Text, References and Software
Recommended Text: none.

Additional References:

5. Lecture Notes (will include a list of internet resources and sources for parts)
Software:

C compliers: http://www.imagecraft.com/software/index.html
Assembler: http://www.pemicro.com/

Internet Resources:

http://www.coe.montana.edu/ee/cady/ee361/hc11lnks.htm
http://www.freescale.com
http://www.evbplus.com
http://www.intel.com
http://www.circellar.com
http://www.eetoolbox.com/

Course Objectives – After completing this course the students should be able to:

1. Understand architectures and operations of a microprocessor or microcontroller system in depth.
2. Apply design methods to select a microprocessor or microcontroller suitable to the application, and find effective solutions to a wide range of real-world microprocessor and microcontroller applications.
3. Perform the detailed hardware design of a microprocessor or microcontroller system, and program the microprocessor or microcontroller using suitable techniques and software tools.
4. Communicate clearly and effectively with the appropriate communication media including power point slides, oral presentation, and written reports.
5. Appreciate the importance of life-long learning and be motivated to continue learning microcontroller-related technologies.

Topics Covered/Course Outline

1. Introduction to embedded systems, microcontrollers, and structured design
2. C programming skills for Microcontrollers
3. Microcontroller Systems Review – programming model, assembly programming, timer, Analog to digital conversion, PWM, interrupts, and programming examples using C
4. Parallel Input/Output Interfacing Concepts: input devices, output devices, interfacing and programming
5. Serial I/O communications: SCI, SPI, IIC, and CAN protocols and programming
6. Memory organizations and interfacing and DMA.
7. Real World Design Issues: CMOS characteristics, noise, and power management
8. Motion detection and control with encoders, sensors, motors and actuators.
9. Embedded control system case study: motor speed control, fuzzy logic control, wall-following robot, etc
10. Real Time Operating Systems
11. Ethics and professionalism in embedded system design.
Relationship to Program Outcomes
This course supports the achievement of the following outcomes:

a) Ability to apply knowledge of advanced principles to the analysis of electrical and computer engineering problems.
b) Ability to apply knowledge of advanced principles to the design of electrical and computer engineering systems.
c) Ability to apply the appropriate industry practices, emerging technologies, state-of-the-art design techniques, software tools, and research methods of solving electrical and computer engineering systems.
d) Ability to use the appropriate state-of-the-art engineering references and resources, including IEEE research journals and industry publications, needed to find the best solutions to electrical and computer engineering problems.
e) Ability to communicate clearly and use the appropriate medium, including written, oral, and electronic communications methods.
f) Ability to maintain life-long learning and to continue to be motivated to learn new subjects.
g) Ability to learn new subjects that are required to solve problems in industry without being on a classroom environment.
h) Ability to be competitive in the engineering job market and/or be admitted to an excellent Ph.D. program.

Prepared by:
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April 30, 2010