ĐẠI HỌC QUỐC GIA TP.HỒ CHÍ MINH
TRƯỜNG ĐẠI HỌC BÁCH KHOA
KHOA ĐIỆN-ĐIỆN TỬ
BỘ MÔN KỸ THUẬT ĐIỆN TỬ

Embedded System Design

Chapter 0: Course Introduction

1

Course Information

- Instructor
  - BUI QUOC BAO, MsC
  - Department of Electronics http://doe.dee.hcmut.edu.vn
  - Email: buiquocbao@hcmut.edu.vn
  - Office: 209B3, Electronics Lab 2, Thursday 9-11am
- Primary course:
  - Micro-processor (Vi xử lý)
- Parallel course:
  - Embedded System Programming (Lập trình nhúng)

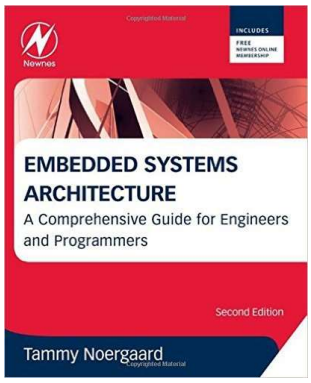
Textbooks

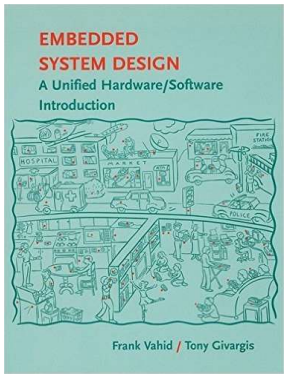
[1] Tammy Noergaard , ***Embedded System Architecture***, Newnes, 2005

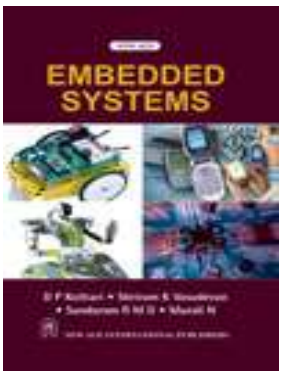
[2] Frank Vahid and Tony Givargis , **Embedded System Design: A Unified Hardware/Software Approach,** John Wiley & Sons, Inc. 2002

[3] Martin Bates, "Programming 8-bit PIC Microcontrollers in C", Newnes, 2008

[4] D. P. Kothari, Shriram K. Vasudevan, Sundaram R.M.D., Murali N., "Embedded Systems", New Age, 2012







Embedded Systems on the Web

- Berkeley Design technology, Inc.: http://www.bdti.com
- EE Times Magazine: http://www.eet.com/
- Linux Devices: http://www.linuxdevices.com
- Embedded Linux Journal: http://embedded.linuxjournal.com
- Embedded.com: http://www.embedded.com/
  - *Embedded Systems Programming* magazine
- Circuit Cellar: http://www.circuitcellar.com/
- Electronic Design Magazine: http://www.planetee.com/ed/
- Electronic Engineering Magazine: http://www2.computeroemonline.com/magazine.html
- Integrated System Design Magazine: http://www.isdmag.com/
- Sensors Magazine: http://www.sensorsmag.com
- Embedded Systems Tutorial: http://www.learn-c.com/
- Collections of embedded systems resources
  - http://www.ece.utexas.edu/~bevans/courses/ee382c/resources/
  - http://www.ece.utexas.edu/~bevans/courses/realtime/resources.html
- Newsgroups
  - comp.arch.embedded, comp.cad.cadence, comp.cad.synthesis, comp.dsp, comp.realtime, comp.software-eng, comp.speech, and sci.electronics.cad

[Srivastava]

Learning Outcomes

1. **Describe** and **analyze** features of an embedded system.
2. **Apply** microcontrollers for embedded systems.
3. **Design** hardware part for an embedded system
4. **Design** software part for an embedded system
5. **Develop** a project of designing an embedded system

Syllabus

(7 chapters, 45 hours, 12 weeks, 4 hours / week)

1. **Embedded System Overview**
   1. What is an embedded system?
   2. Embedded System Features
   3. Embedded System Design Process
2. **Develop a project of embedded system design**
   1. Design Process
   2. Project Description
   3. Project plan
3. **PIC Microcontroller**
   1. PIC16F Series
   2. PIC16F84
   3. PIC16F877
   4. C program for PIC

Syllabus

4. **Hardware design for an embedded system**
   1. Design block diagram
   2. Choose hardware components
   3. Design detail schematics
5. **Software development for an embedded system**
   1. Design algorithm flowchart
   2. Program control software
   3. Use timer and interrupt
6. **Development tools for embedded system design**
   1. MPLab
   2. Proteus
7. **Design peripherals for an embedded system**
   1. Control devices
   2. Analog input/output
   3. Serial communication

Schedule

Week	Lecture
1	Chapter 0, 1
2	Chapter 2
3	Chapter 3
4	Chapter 3
5	Chapter 4
6	Chapter 5
7	**Midterm exam**

Week	Lecture
8	off
9	Chapter 6
10	Chapter 7
11	Chapter 7
12	Project report
13	Extra

Grading

- Midterm exam: 20%
- Final exam: 50%
- Project: 30%
  - 2-3 students for one group
  - Select project's topic at **week 3**
  - Submit project at **week 15**

Course Preparation

- Textbooks:
  - download 3 required textbooks
- Software tools:
  - MikroC
  - Proteus
  - CCS C (PIC C)
- Programming knowledge:
  - C/C++ programming

Project's Topics

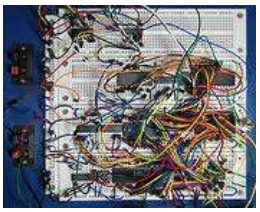
1. 20-Chasing LEDs (>10 modes)
2. LED Message Board (8x32)
3. 3D-LED cube (3x3x3)
4. LED fan display
5. Two-LED Dice game
6. Product counter
7. Digital clock with LCD display
8. Voltmeter with LCD display
9. Calculator with keypad and LCD
10. Serial communication-based calculator
11. IR remote control
12. RF remote control
13. GPS monitor
14. RFID card reader
15. Step motor controller
16. DC motor controller using PWM
17. Servo motor controller
18. I2C data communication
19. Battery charger (1A)
20. Temperature controller
21. Alarm controller using IR LED
22. Automatic light controller
23. Simple music keyboard
24. Digital door lock
25. SD card control
26. Remote control via Ethernet
27. Home security system
28. Heart-beat monitor
29. Bluetooth communication
30. Zigbee communication

Project's requirements

- Report in MS Word
- Simulate the design in Proteus
- Make prototype by bread board or PCB board.
- Present the design in class (option, bonus score)

Note:

1. Do not select too difficult project, your grading depends on how you **apply the design process** for your project
2. The report must be written following the **embedded system design process**
3. **Teamwork** is considered for grading
4. **The design** can be implemented by bread-boards or PCB boards or development kits



Course Overview

1. Which are the embedded systems?
   a. MP3 player?
   b. Traffic light controller ?
   c. Laptop ?
   d. Car ?
2. What is an embedded system?
3. What are differences between embedded system and general computer system?
4. What are applications for embedded systems?
5. What is the most important part in an embedded system?