Post-Modernism

Introduction

- Instructor:
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- Guest Lecturer:
  - John Gill, Associate Professor ISL
- TA:
  - David Black-Schaffer, Graduate Student, EE
Lecture #0 Outline

• Administrative Trivia
• What is an embedded system?
• Designing embedded systems
• Introduction to the AVR
• Lab #0: Start Thinking About Your Project
• Lab #1: Blinking Lights on the STK-500

Administrative Trivia

• Maximum Class Capacity
• Course Information Sheet
  – Contact Info
  – Lab
  – Lectures
  – Grading
  – Late Policy
  – Online resources
Survey: Have You...

- got a windows PC? (or linux?)
- programmed in assembly and C?
- ever used a logic analyzer?
- ever worked with microcontrollers before?
- ever soldered before?
- ever built anything for fun?

What is an “embedded system”? 

- What makes a microcontroller:
  - Self Contained
    - CPU
    - Memory
    - I/O
  - Application or Task Specific
    - Not a general-purpose computer
    - Appropriately scaled for the job
But What About…

- Embedded PCs?
- "Soft" Processors on PLDs?
- Systems On A Chip?

Designing Embedded Systems

- Microcontrollers
  - Don’t have keyboard and monitor jacks
  - Must use ports to perform I/O
    - Inputs – to sense things
    - Outputs – to control things

- Related Component Topics
  - Cool Parts
  - Common Interfaces
  - Part Packages
What You’ll Do:

– Labs
  • Lab 0 – Think about your project
  • Lab 1 – Blinking Lights (pushbuttons and LEDs)
  • Lab 2 – Ascii-to-Morse Converter
  • Lab 3 – LCD Clock
  • Lab 4 – “Video Paint”
  • New ideas welcome…

– Presentation

– Final Project
  • Hardware
  • Report
  • Presentation

Are you still reading these?
Introduction to the AVR

- AVR Studio Assembler Example
- Assembler Directives
- AVR Instruction Set
- More About The AVR

AVR Studio Example

- What does it generate?
  - .obj
  - .hex
- How about blink.asm?
  - Set up a project
  - Run in simulation
  - Look at generated files…
Assembler Directives

- .device
- .include
- .org
- .def
- .equ
- .db

AVR Instruction Set

- What were they trying to do?
- How did they implement it?
- What are the “useful” instructions?
More about the AVR

- What are the features of RISC?
  - 1 instruction per clock cycle (pipelined)
  - Lots of registers: 32 GP registers
  - Register-to-register operation

- Variations in the parts:
  - TINY to MEGA
  - ATtiny10
    - Processor has only 8 pins – what good is it?
  - ATmega128
    - Processor has 64 pins – what do I need them all for?

Databooks Online

- Virtually all new part datasheets are available online.
- Paper databooks are static.
- Online errata can save you from headaches.
Lab Assignment #0

- What do you want to make?
  - Cool Toy
  - Communication Widget
  - Specialty Control System
  - Pointless Active Desk-Art
  - A “Killer” Device
- Details about the basic project requirements will be posted on the web page

Lab Assignment #1

- Blinking Lights.
  - Make sure you can make AVR Studio work.
  - Figure out some variations on the demonstration program.
    - Dealing with Button Bounce
  - Get comfortable with the AVR Instruction Set.