Programming for Embedded Systems
Lecture 8: ADC and Analog Comparator

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Schedule Through May

- Projects
  - 2 small
  - 1 larger, two-part project
- Quizzes
  - To keep you honest

Remaining Topics

- Analog Input
- Data structures for embedded programming
- Communication
  - Board to board
  - With a peripheral

What We've Done

- Digital I/O
  - And approximating analog output
  - Analog output
- Interrupts
- Timers
- Low Power Sleep Mode

Let's Put Those Together

- ... and do a project!
- Use the button on the Launchpad for input
  - Going to recognize Morse Code for digits 0-9

Morse Code

- Morse code is made up two kinds of tones
  - short tones (dots)
  - long tones (dashes)
- Use button presses as the "tone"
- Use a timer to count the tone duration

Digits 0-9

- Each digit consists of five tones
  - 1 is "dot dash dash dash dash"
  - 2 is "dot dot dash dash dash"
  - And so on, see http://en.wikipedia.org/wiki/Morse_code
- So you need to store an array of several tones

Ending a Digit

- In Morse Code, digits are separated by silence of 3 dot units
- We'll simplify this
  - Only doing 1 digit messages
  - Consider message done after
    - 5 tones or
    - 2 seconds of silence

Telling Dots from Dashes

- Technically, dashes should last for three dot units
- Again, we'll simplify
  - Remember the longest and shortest tones in the digit
  - Let middle = (longest + shortest)/2
  - Anything shorter than middle is a dot
  - Anything longer than middle is a dash

Output

- Digit successfully decoded
  - Flash the green LED the same number of times as the digit
  - Ignore button presses until the LED flashing is done
- No successful decode
  - flash the red LED once

Power Consumption

- You should stay in LPM3 after start up
  - Use interrupts to catch button presses
    - Will need to switch between rising and falling edge
  - Use a timer to trigger other interrupts
- Should see μAmps drawn, not mAmps
  - When the LED is off
  - LED will draw more when on

Pulldown Resistor

- Don't forget to enable the pulldown resistor!

The Individual Nature of the Project

- The project should be finished individually
- It's okay to talk about how stuff works
- It is not okay to give out or copy code

Today

- Today everyone can start on the project
  - Feel free to ask questions, etc
  - Due on April 7
- I will also get everyone's crystal working
  - Many of you have bad connections to the ground plane

Wednesday

- Quiz on topics for the Morse Code project
  - I/O, Interrupts, Timers, and Low Power Mode
  - Force you to start working on it
- Then introduce analog input
  - Analog to Digital input
  - Analog level comparator