Welcome to CMPT 433
Embedded Systems

1) Introductions
2) What's an embedded system?
3) Course overview
4) BeagleBone Black & Zen Cape preview

Do the "Boot-up" Quiz; and
Write your name on its back in
HUGE letters

Instructor: Dr. Fraser - call me Brian

Guide to Slides

- Slide Colour Guide (often...):
  - Green: headings.
  - Yellow: Highlighted text.
    - This course has no midterm and one final.
  - Blue: Term being defined.
    - Hour: 60 minutes.
  - Sweep-in Text: Blanked out text.
- Joke:
  - There are 10 types of people in the world...
Classroom Expectation

- Only one thing:
  - Texting, playing games, checking facebook (back row)
  - Talking (vs participating!)

- If sending me or TA an email:
  - Give a little context (class, your name, topic, ...)
  - U Shd rite th3 msg so i wnt 2 reed it

- If sick, please email vs coming to office hours.
  (kids at home; don't want to get sick!)
- Email: If you are sending more than 2 a week, may be too many.

What is an embedded system?

- Embedded System:
  - A Computer system designed to do...
  - Usually does not have a keyboard, screen, mouse.

- Spectrum of Examples:
  - Controller in an AA-battery recharger.
  - Controller in a laser printer.
  - Air-quality controller on international space station.
  - Control software in an autonomous vehicle.

Statistics

- 2008:
  - 10 billion CPUs manufactured. (~6.7 billion people on Earth)

Language Choice (2013)

[Statistical data and chart showing language choice]
Embedded System Development

- Cross-compiling:
  - Development done on the PC using powerful tools: editor, compiler, debugger, etc.
  - Compiled code...

Discussion

In groups of 3 to 4 people:
- Exchange email address;
- Answer the following:

1. What are 5 different embedded systems in the room right now? Which is most interesting?

2. What one computer failure could be most life critical? Is it an embedded system?

3. What is the best or worst thing an embedded system could be used for?

Course Overview

- Goal
  - Qualified for junior embedded software developer.
  - Course mostly...
    • May spend hours solving build issues, and downloading code to device.

- Course Components
  - Embedded Basics & Hardware
  - Linux Coding & Admin
  - Linux Kernel & Drivers
  - Bare Metal
What to expect

- Previous students have found this course:
  - very rewarding to do so much hands-on, and
  - very time consuming to do so much hands-on!

- So be ready for:
  - A lot of C/C++/Linux programming
  - Steep initial learning curve working with real HW
  - Group work
  - Spending good time on this course each week.

- Stay on top of assignments and how-to guides.

- Submitted assignment code may be reviewed in lecture (anonymously)

Admin Review

- Review Admin sheet:
  - Assessment %'s, no midterm exam.
  - Quizzes: A couple days after how-to guide released.
  - Assignments: Individual/pairs to learn skills.
    *Anon code reviews in class may feature your code*
  - Project: group (3-4) to accomplish more.

- Academic Honesty:
  - I am passionate about proving who did their own work.
  - Corollaries:
    - I'll give you credit for the work you do.
    - I'll catch those who don't do their own work.

Hardware Package

BeagleBone Green (BBG)

![Diagram of BeagleBone Green (BBG)]
Zen Cape

- 2 character Display (via I2C)
- Audio Out
- Audio In
- Potentiometer (analog)
- EEPROM
- Joystick (GPIO)
- 2x Tri-colour LED (GPIO and PWM)
- Buzzer
- Buzzer Disable Jumper
- Serial via USB (micro USB)
- Accelerometer
- EEPROM
- Joystick (GPIO)

BeagleBone & Zen

Demo

- BeagleBone Black Demo
  - Boot & show in terminal
  - Linux commands: ls, cd, echo
  - Blink LEDs
  - Ethernet ping / web server

Logistics

- Boards not yet here from manufacturer
  - Hope to sell to students in a week.
- Buying a Board Package
  - Package includes:
    - BeagleBone, Zen cape, mounting board, anti-static bag, USB cables, electronics, box.
  - Sold for about $200 or less (taxes included)
- Academic Honesty
  - Each student must have own board: sharing encourages too much cooperation.
Summary

- Course is hands on:
  - Learning skills, not so much theory.
  - Expect to spend quite a bit of time figuring things out
- Hardware to be sold in ~1 week
- Complete your Boot-up quiz now and hand it in!