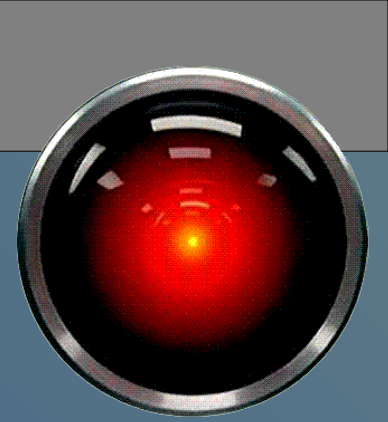
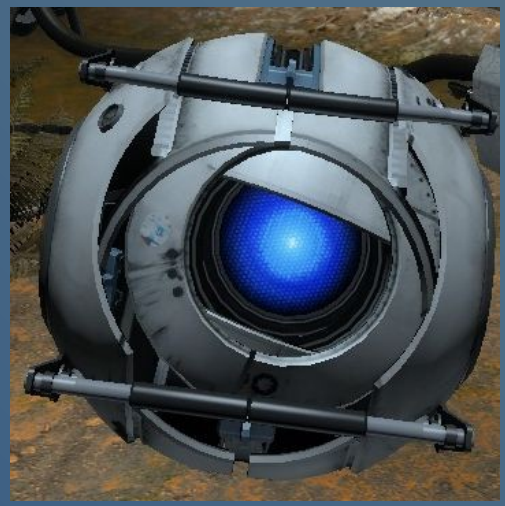


# Welcome to ENSC 351
# Embedded and Real Time System Software



@ Dr. Brian Fraser
Presented by Morteza Badali

# Topics

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

# Course Materials

## FRASER, BRIAN

Senior Lecturer, School of Computing Science

### Education

Ph.D. Computing Science, Simon Fraser University, Canada, 2009

B.Sc. Computing Science, Simon Fraser University, Canada 2002

### Teaching Interests

- Software engineering, including development methods, object-oriented design, and programming languages
- Embedded systems

# What do I notice?

- Worried & Excited: Top most common words!
- Many different backgrounds
  - We won't assume much about Linux use
  - We won't assume much about programming experience (especially not multithreaded..)
  - We'll cover everything!

# What is an embedded system?

# What is an Embedded System?

- Real-time Embedded System:
  - Embedded systems:
    A Computer system designed to do...
    one dedicated and specific function. (wikipedia).
  - Real-time systems:
    Must respond to events..
    within a predictable specific time constraint.
- 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.

# Embedded System Development

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

Host

Compiled Code

Target

# Discussion

In groups of 3 to 4 people:

- Exchange email address;
- Answer the following:

1. What are 5 different embedded systems in your rooms 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... hands on; not much theory.
    - *May* spend hours solving build issues, and downloading code to device.
- Course Components

# Course History

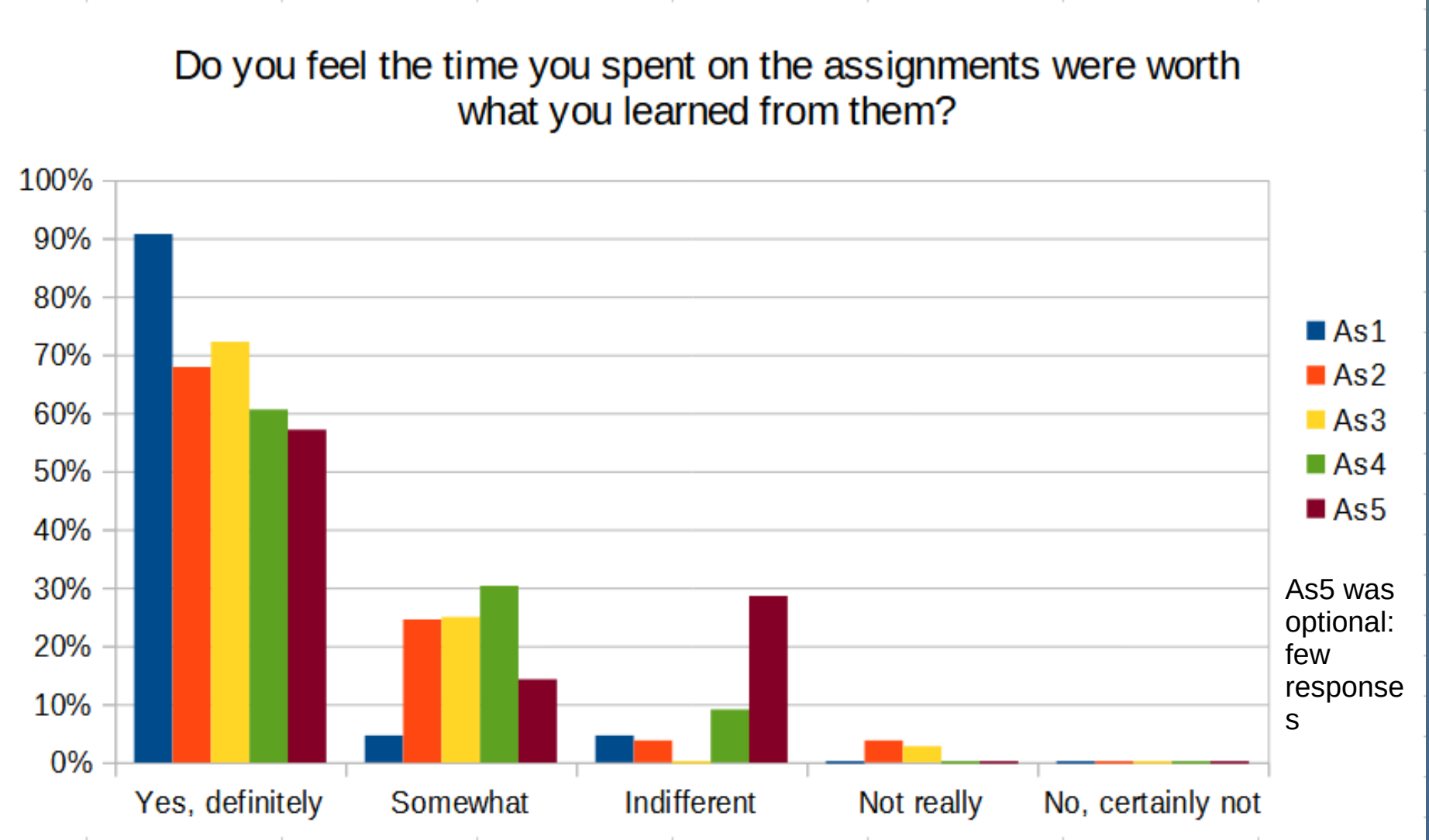
- Based on CMPT 433: Embedded Systems
- Here in ENSC 351 we'll spend more time reviewing and learning:
  - C programming
  - Linux programming (files, mutexes, ports, ...)
- We are likely going to skip some CMPT 433 content:
  - Circuits
  - Kernel drivers and Bare metal
  - Web pages
- Like 433, we'll learn all about how to develop under Linux, and take pride in our code!
  - Throughout the semester we'll ensure students of all backgrounds are having success.
  - We will add time on topics as needed

# 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/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 code may anonymously be discussed in class

# Hours spent working on assignment (2021 Spring)

# Learning worth the time (2021-Spring)

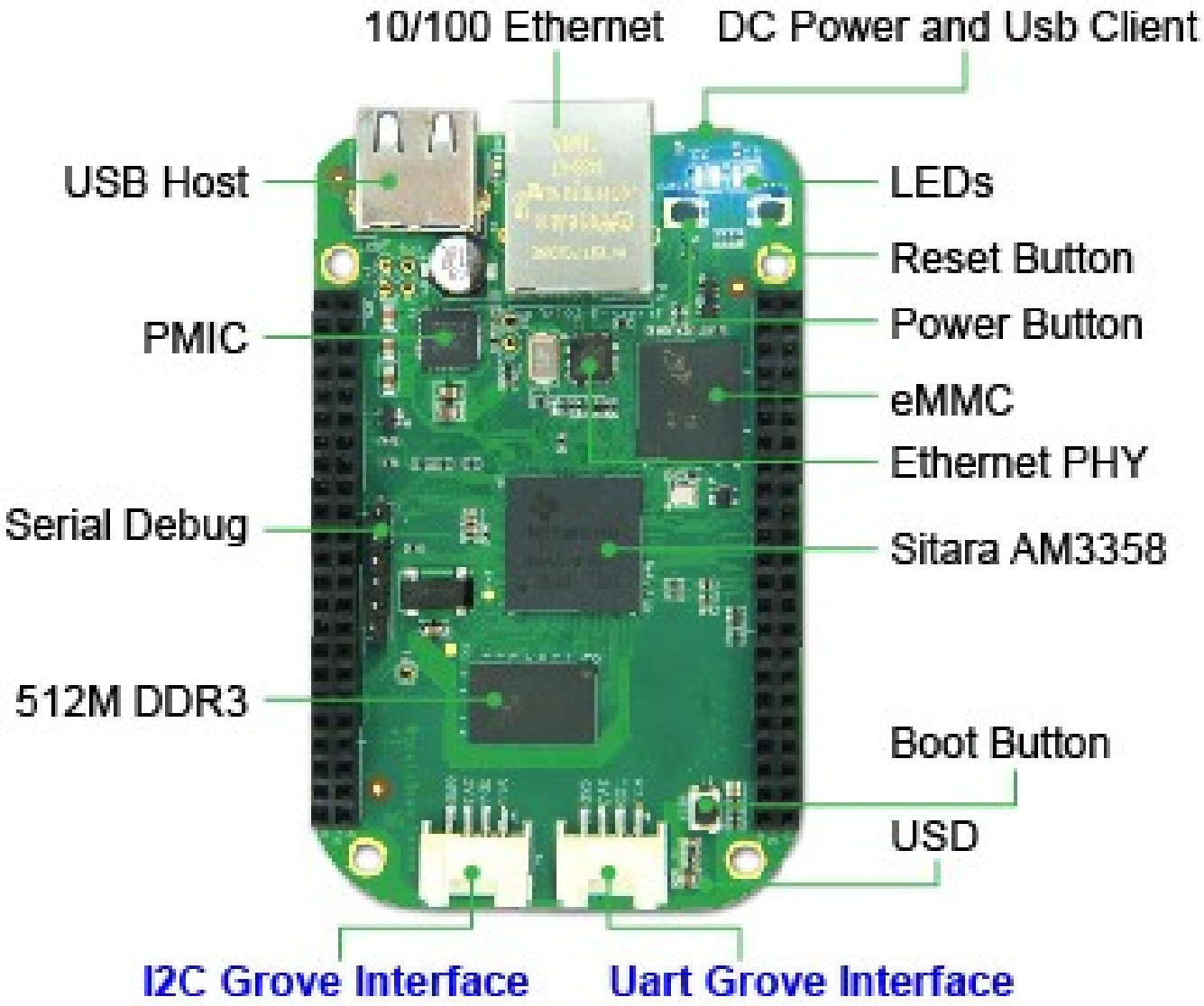


# Admin Review

- Assessment
  - Quizzes 20%
  - Assignments 50%: Individual/pairs to learn skills
    *Anon code reviews in class may feature your code!*
  - Project 30%: group (3-4) to accomplish more
  - Grade breakpoints (“% for B+?”) may be non-standard
- 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.

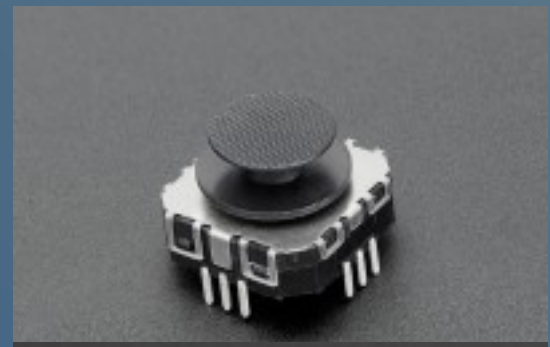
# Hardware Package

# BeagleBone Green (BBG)

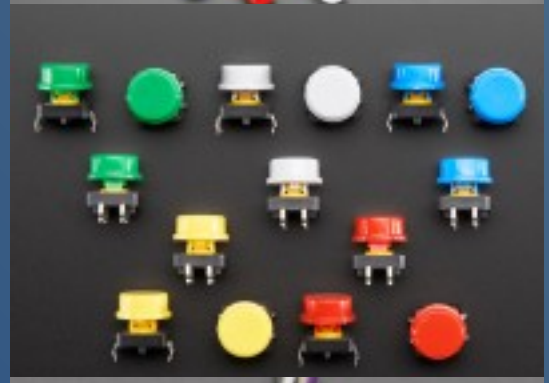


# Components

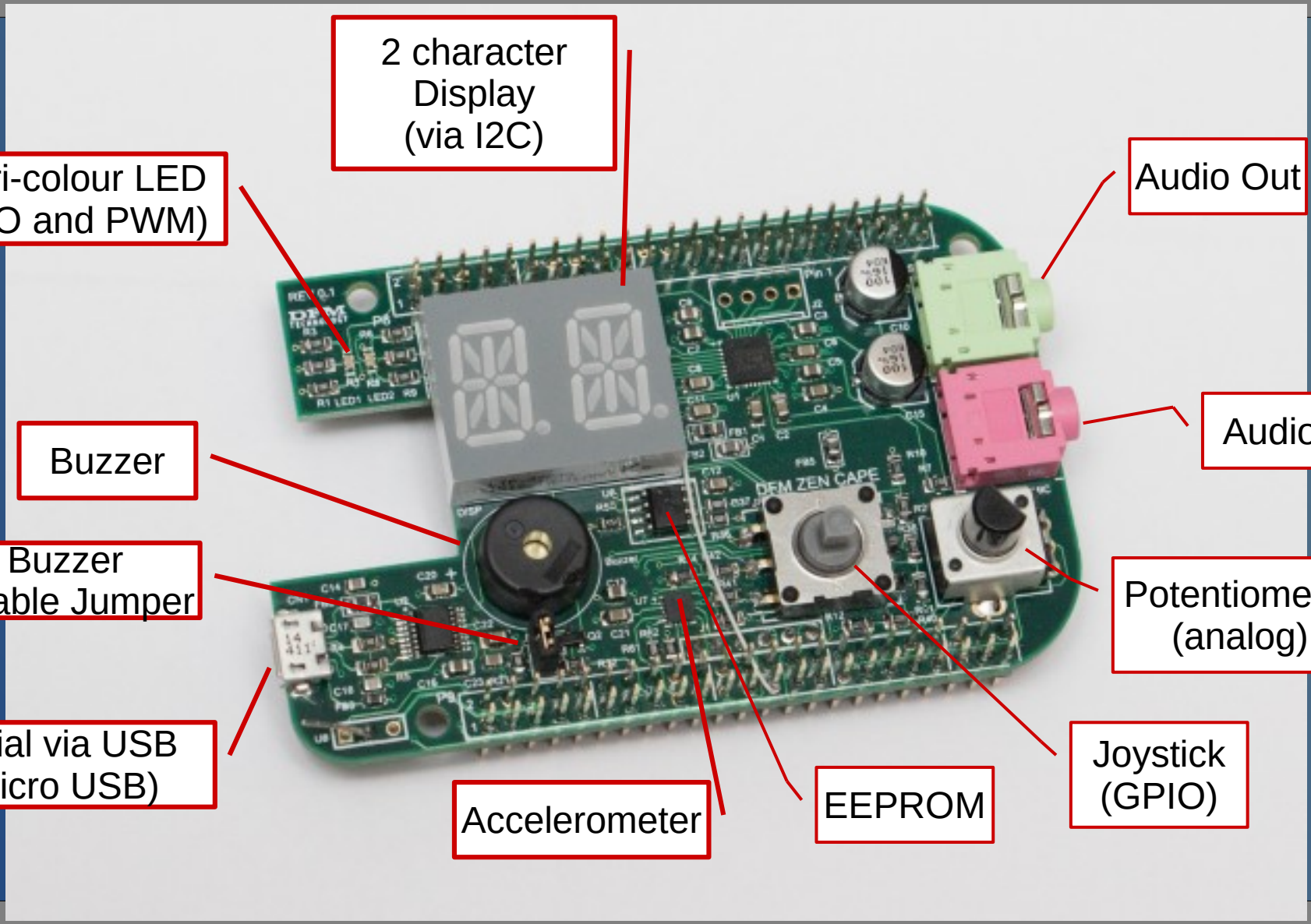
- Kit will include hardware, such as the following:



# CMPT 433 uses: Zen Cape



# Demo

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

# Summary

- Course is hands on:
  - Learning skills, not so much theory.
  - Expect to spend quite a bit of time figuring things out
- Have fun!