EECE416 :Microcomputer Fundamentals and Design ("Microcomputer & Microprocessor")

Fall 2013

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Howard University

Course Introduction

- **EECE416: Microcomputer Fundamentals**
  - CRN 80105
  - TR 1710-1830 @LKD3121
  - Dr. Charles Kim (LKD 3014) 202-806-4821; ckim@howard.edu
  - Office Hours: T 2-4 W 4-5, and F 2-4
  - TA and Assistant: ??
- **Course Focus**
  - Theme- Intel x86-based curriculum with utilization of Atom-based boards
  - Secondary - Introduction of small microcontrollers that can find many applications, such as Basic Stamp, PIC, Arduino, and Raspberry Pi, etc
  - **Emphasis 1:**
    - IA 32 and x86 Architecture as background information – MASM32 Assembly language
  - **Emphasis 2:**
    - Microcontrollers and their applications
    - Embedded SW Development and Debug Tools (Application Environments) and Real Time Programming (Hardware/Software) for Atom boards.

Learning Outcomes - ABET

- **(c) An ability to design a system component, or process to meet desired needs**
  - Programming of assigned works
  - Programming of class projects
- **(j) An ability to use the techniques, skills and modern engineering tools necessary for engineering practice**
  - Familiarity in assembly language coding environment
  - Microcontroller Programming Development Tools
- **(k) A knowledge of contemporary issues**
  - Assignment on emerging technologies and their socio-cultural impact
    - Go-green
    - Sustainability
    - E-waste
    - Robots
  - Patent Disputes surrounding smartphones between Apple and Samsung
  - Next Gen Smartphones → new direction?

Course Structure and Focuses

- ⌘ Computer Architecture in General
  - ⊡ Computer History
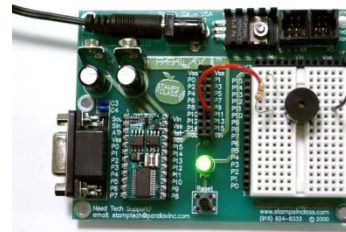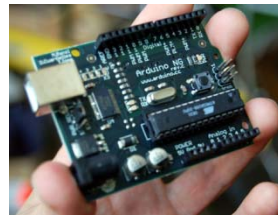 - ⊡ Computer Architecture-brief (ISA)
- ⌘ IA32 and MASM (Microsoft Assembler)
  - ⊡ Architectural Study
  - ⊡ Instruction Sets
  - ⊡ MASM32 and Code Viewer
  - ⊡ Programming Practices& **coding Project**
- ⌘ Microcontrollers
  - ⊡ **Arduino**
  - ⊡ **Basic Stamp**
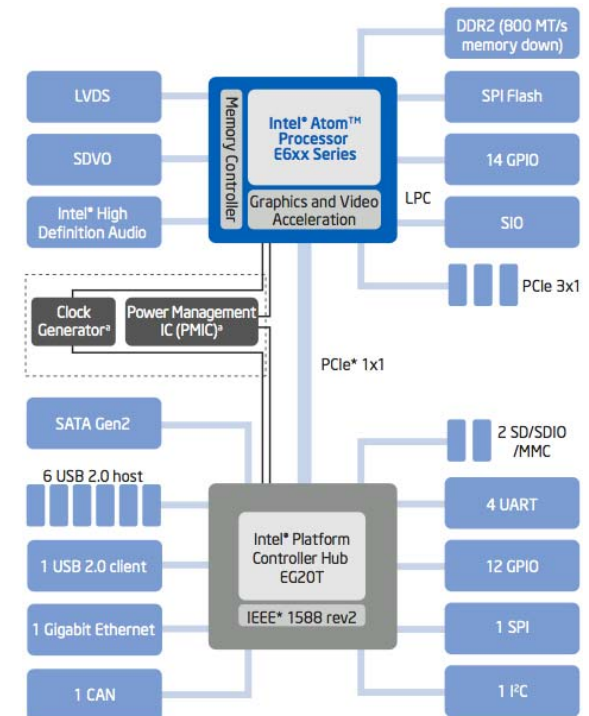 - ⊡ Raspberry Pi
  - ⊡ **Project**
- ⌘ Intel Atom-Based Board
  - ⊡ Architectural study
  - ⊡ Programming Environments
  - ⊡ Programming Practices
  - ⊡ **Projects**

- ⌘ Class Web Page: www.MWFTR.com

4

Text and Resources

- Intro to 80x86 Assembly Language and Computer Architecture,
  - Richard Detmer, 2nd Ed
- Helpful Books on System Integration with Intel Atom Processor Board
  - "Break Away with Intel Atom Processors" and "Study Guide" by L. M. Matassa and M. Domeika
  - "Modern Embedded Computing" by P. Barry and P. Crowley
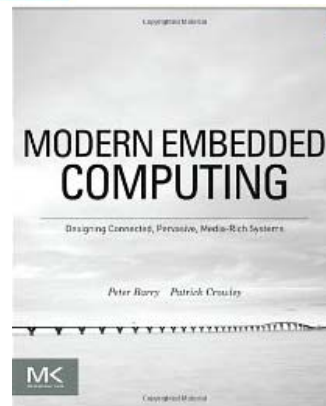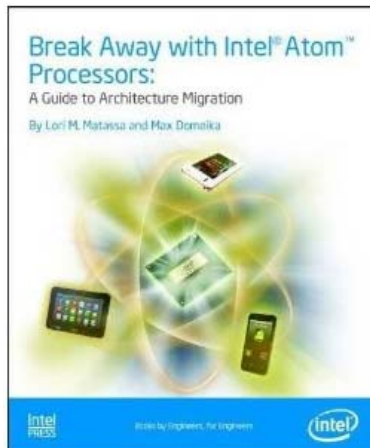 - **Above two books are available for check out through the course offering**
- Resources
  - Art of Assembly Language Programming
    - Randall Hyde
    - http://www.arl.wustl.edu/~lockwood/class/cs306/books/artofasm/toc.html
    - Chapter 3 –>

5

Course Expectations

- Lecture + Programming Lab Combination
- Active Participation in Lecture and Lab
- Timely Submission of Program Practices
- Individual/Group Works –PC/Laptop use in Classroom is highly recommended (especially in the LAB)
- An Early and Essential Element for Senior Design Project Implementation & a must for Embedded-Computing Class (Spring 2014)
- Also, there will be a new course "SoC Interfacing and Computer Bus" (tentative title)

Grading

- ⌘ Mid-term Exam - 20%
- ⌘ Final Exam – 20 %
- ⌘ Assignments (Coding etc.) – 20%
- ⌘ Projects – 20%
- ⌘ Essay Writing on Contemporary Issues (emerging technology in computer and embedded systems) – 10%
- ⌘ Attendance – 10% (On-time arrival only)
- ⌘ Grades:
  - ⌃ A: 90% or above
  - ⌃ B: 80 – 89 %
  - ⌃ C: 70 - 79 %
  - ⌃ D: 60 – 69 %
  - ⌃ F: 59% or below

Class Schedule (Tentative)

- August:
  - Week 4 – Class Introduction and Computer History
- September:
  - Week 1 – Computer Architecture
  - Weeks 2 – 4: IA32 & MASM32 & Coding practice
- October
  - Week 1: Mid-Term Exam
  - Weeks 2- 4:Microcontrollers {Basic Stamp2 and Arduino (and Raspberry Pi) }
- November
  - Week 1: Microcontroller Project and Presentation
  - Weeks 2-4: Atom Board System and Coding Practice
- December
  - Week 1: Final Exam

Advice for success in the class

- ⌘ Be on time – Important things are covered at the very first moment and at the very first few classes. (80/20 rule)
- ⌘ Finish work in the class – Do not postpone or extend the work to the evening/night hours.
- ⌘ Bring your own Laptop – It would be more convenient and productive than using a PC in the class.
- ⌘ Do your first coding work yourself and master it – all other coding practices will be built on the first work.
- ⌘ Office Hour
  - ⌄ Open Door Policy (except 1200 – 1300 lunch hour)
  - ⌄ By appointment (or just walk-in)

Cornell/Intel Cup 2014?

- Cornell Cup 2014 presented by Intel is expected to be announced.
- Purpose:
  - USA national contest for embedded systems - Intel Atom board based Design and Implementation
  - College-level embedded design competition created to empower student teams to become the inventors of the newest innovative applications of embedded technology.
- Proposal deadline: October
- Year-long experience and 2-day summit at Walt Disney World (?) or ???
- Open to all Undergraduate or Masters Engineering and Computer Science students in any accredited US university
- Teams of 3-5 students will create detailed design plans, a working prototype, and a final presentation that effectively demonstrates the capabilities and robustness of their ideas -- $2500 award each team for travel to the final competition site.
- **Additional Perks**
  - A student or 2 may be arranged to attend the annual Intel Embedded System Research and Education Summit in Feb/Mar (Chandler, AZ) --- Travel scholarship
  - 2012: Ravi Jaglal and Gerard Spivey
  - 2013: Ade Akinsiku
  - 2014: ??

Howard' Success in Cornell/Intel Cup 2012 and 2013

- ⌘ 2012:
  - ⌃ 2 team proposals were submitted
  - ⌃ 1 ("Green lighting") was selected as the finalist
    - ☒ Chidi Ekeocha, Shamir Saddler, Ameer Baker, Isaac Collins, Ravi Jaglal
  - ⌃ 1 ("Blind Assistant") was selected as a wild card
    - ☒ Gerard Spivey, Joshua Durodola, Antonio McMichael, Keir Morris, Christopher Urquhart
  - ⌃ The "Blind Assistant" won the Wild Card Winner in the Final Competition in May 2012

- ⌘ 2013:
  - ⌃ 2 proposals were submitted
  - ⌃ Both teams were selected each as a finalist
    - ☒ Water: Eric Turner, Henok Mazegia, and Ade Akinsiku
    - ☒ Smart Backpack: Paul Alade, Ellwood Lane, Jennifer Okafor, Samuel Omosuyi, and Kalonji Bankole
  - ⌃ Team Sigma ("Smart Backpack") earned the Honorable Mention award

Charles Kim – Howard Uni

Who are the finalists in the 2012 Cup?

⌘ 2012:

- University of California, Berkeley – Solar Drone
- University of California, San Diego – Sentinel
- Columbia University – Columbia SWARM
- Georgia Institute of Technology – GT Accessors
- Georgia Institute of Technology – GT Night Rover
- University of Houston – Audio Fusion
- Howard University – Green Lighting
- University of Massachusetts, Amherst – Automated Aero-Painting System
- University of Massachusetts, Amherst – Team Wolf
- University of Massachusetts, Lowell --- JouleCycle
- Massachusetts Institute of Technology – Team Sqirtle
- University of Pennsylvania – HAWK
- University of Pennsylvania – Kinecthesia
- Pennsylvania State University – Kidz, the Mystics
- **Portland State University – IVS [Winner]**
- Purdue University – Incredible HUD
- Seattle Pacific University – Team DART
- University of Southern California – Team Visionary
- Southern Illinois University at Carbondale – Hot Dawg
- Vermont Technical College – Knights of the Workbench
- Worcester Polytechnic Institute – FIVOLTS
- Worcester Polytechnic Institute – Think Chair
- Howard University – Blind Assistant (Wild Card)

12

Who are the finalists in the 2013 Cup?

⌘ 2013:

- University of Massachusetts, Lowell – Autonomous Robotic Mechanism
- University of Pennsylvania – Autonomous Airborne Vehicle
- Columbia University – Assistive Robotic Manipulator
- Arizona State University – Human-Computer Interaction
- Howard University – Bison Technology
- Worcester Polytechnic Institute – Cyber Physical Systems
- Worcester Polytechnic Institute – FIVOLTS
- University of Colorado, Denver – Intracell
- University of Massachusetts, Lowell – LEAF
- University of California, Berkeley – Mengbaolity, intelligent shopping cart
- Oregon State University – MetroSwift
- Oregon State University – MoJo2
- Seattle Pacific University – Nia Wheel
- Columbia University – Ouroboros
- University of Pittsburgh – PandaCare
- Florida Institute of Technology – Panther 1
- University of Massachusetts, Amherst – Personal Black Box
- University of Pennsylvania – ProtoDrive
- Southern Illinois University – Salty Dawg

⌘ 2013 (-continued):

- University of Rochester – Swarm UV
- Purdue University – Table It
- University of Massachusetts & B. V. Raju Institute of Technology – Team BioBot
- University of Houston – Team Ignitus
- Columbia University – Team Lions
- Howard University – Team Sigma
- Arizona State University -- Techpriests
- **University of Pennsylvania – Titan [Winner]**
- University of California, San Diego – UAV Tracker
- University of Rochester – Uread Braille
- University of Pennsylvania – Vision Interactive Operating System

14

Cornell Cup 2014:
Are you in the game? Or on the sidelines?

- ⌘ Visit the Cornell Cup website
  - ⬠ Cornell University, System Engineering
- ⌘ Read Team summaries of 2012 and 2013
- ⌘ Brew up an idea or two, new and interesting ones
- ⌘ Share with friends (Howard and Brazil students)
- ⌘ Form a team
- ⌘ Write a 1-pager of summary
- ⌘ Come see me before the end of September
- ⌘ Why can't we send another 2 teams for 2014 competition?