Introduction to Microcontroller

Lecture 1

Yeongpil Cho

Hanyang University

About me

- 조영필 (Yeongpil Cho)
  - A system security researcher
  - Designing new SW/HW techniques for better security
    - OS kernels
    - Hypervisor
    - Firmware
    - Applications
    - etc.

Course information

- Goal
  - **Microcontrollers**, widely found in embedded systems, are tiny computer systems, consisting of a CPU, memory and peripherals.
  - You will have a good understanding of microcontrollers and furthermore general computer systems.
- Class time & location
  - Theory classes
    - Mon. 11 am @ ITBT 207
  - Practice classes
    - Tur. 6 pm @ ITBT 207
- Course materials
  - (main) Lecture notes
  - (auxiliary) Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C: Third Edition

Course information

- Grading policy
  - Midterm: 20%
  - Final: 20%
  - Lab assignments: 20%
  - Term project: 30%
  - Attentance:10%
    - 3 tardies → 1 absence
    - 1/3 or more absence → grade 'F'
    - Using the Smart Attendance System
- Office hour
  - Make an appointment at any time
    - ypcho@hanyang.ac.kr
  - Location: ITBT 1208
- TA
  - Jinhwan Kim (김진환)
    - adsll156@hanyang.ac.kr
  - Taewook Kim (김태욱)
    - qkenr7895@hanyang.ac.kr

접속하기

[접속방법 3가지 중 선택]

1. 한양대학교 앱을 다운받아 설치 후 전자출결 클릭.

2. 스마트폰 이나 개인 PC에 바로가기를 만들어 사용

Hanyang
Smart Check

③ 인터넷 주소창에 주소를 입력하여 사용
주소 : https://check.hanyang.ac.kr

인터넷

check.hanyang.ac.kr

출석 하기(로그인)

① 로그인 화면

학생을 클릭하고 로그인 한다.

ID : 학번 비밀번호: portal PW

② 자동로그인 체크

자동로그인을 체크하고
로그인 하면 다음 접속시 자동 로그인이 된다.

※ 위치기반을 체크합니다.
모바일로 접속을 했을 경우 위치를 체크한다는 문구가 뜰 수 있습니다. 출결에는 지장이 없지만, 교수님 화면에 위치측정이 안된다고 표시되기 때문에 되도록이면 위치기반 허용!!

출석(시간표) 화면

① 로그인을 하면 바로 해당 날짜에 해당수업을 표시해 준다.
상단 탭을 보면 일별/ 주별/ 월별로 수업시간표를 확인가능

② 지난 출석에 대한 결과 및 해당수업 출석률을 보여줍니다.

③ 지난 출석중에 [이의]가 있는 경우 이의신청을 할 수 있다.

④ 교수님이 출석 체크는 시간별로 출석을 나눠 부르거나
합쳐 부르실 수 있습니다.

⑤ 해당수업에 메모를 하거나 해당 교수님께 쪽지를 보낼 수 있습니다.

출석 인증번호 입력

① 교수님이 불러주시는 [인증번호]를 입력하시고
[출석등록]을 누르시면 됩니다.

※ 잘못 입력했을 경우에는 당황하지 말고 다시 입력하면 됩니다.
(교수님이 마감 버튼을 누를 때 까지는 입력이 가능합니다)

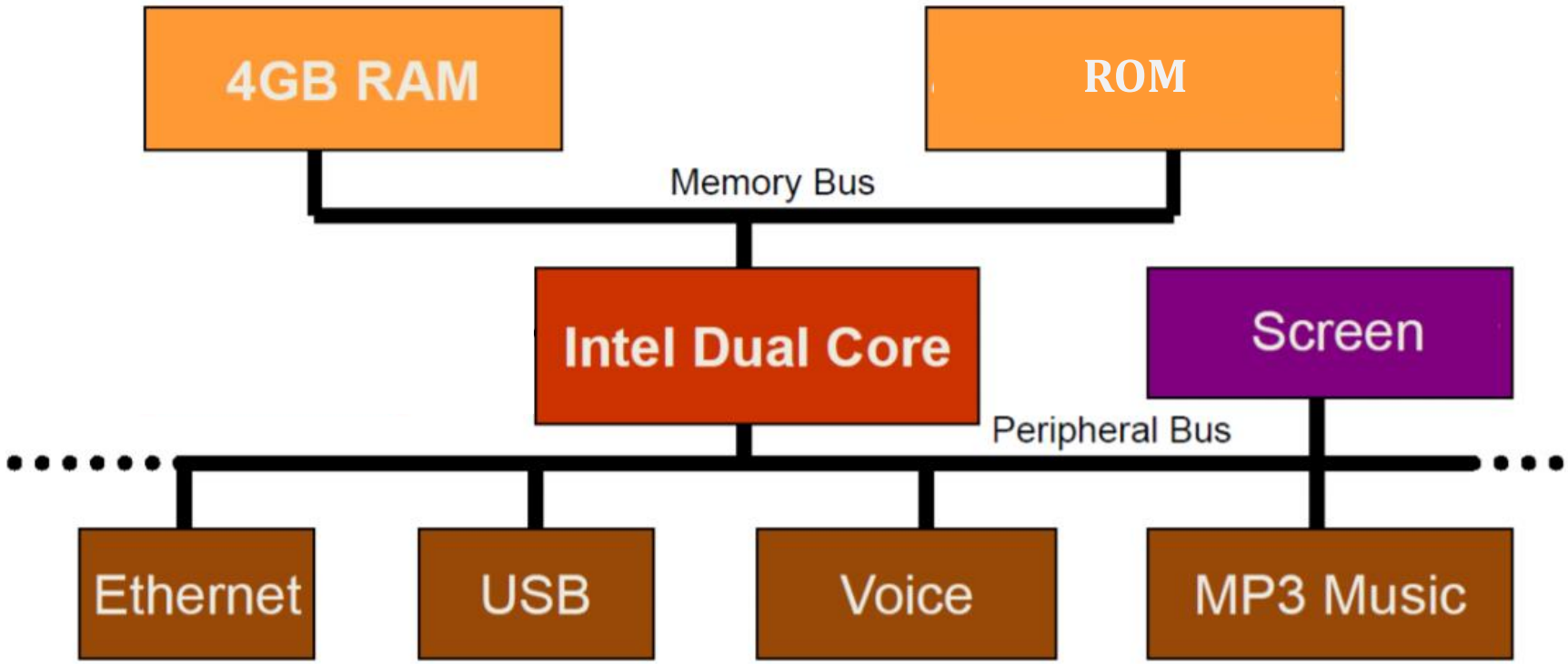
Tentative Syllabus (Theory Classes)

잠정적인 강의계획서

Week	Date	Lectures
1	9/5	Course Overview
2	Chuseok	Basics in Computer Architecture (online video)
3	9/19	Introduction to ARM Architecture & Overview of Cortex-M processors
4	9/26	Memory system in Cortex-M processors
5	Gaecheonjeol	ARM Assembly Language I (online video)
6	Hangulnal	ARM Assembly Language II (online video)
7	10/17	Midterm Exam
8	10/24	ARM Assembly Language III
9	10/31	Cortex-M's subroutine mechanism
10	11/7	Cortex-M's interrupt mechanism I
11	11/14	Cortex-M's interrupt mechanism II
12	11/21	Cortex-M's timer and GPIO
13	11/28	Final Exam
14	12/5	Term Project
15	12/19	Term Project
16	12/26	Term Project

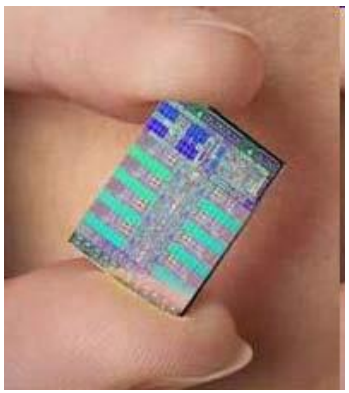
What is a microcontroller?

General Structure of Computer



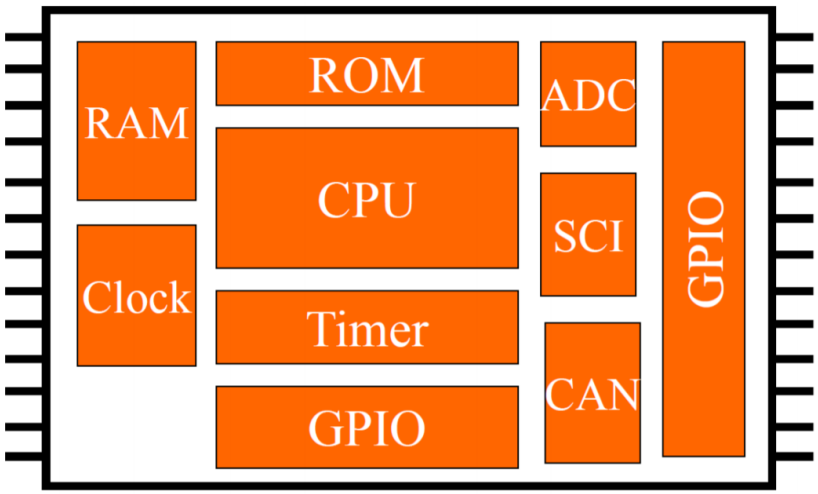
What is Microcontroller?

- Microprocessor vs. Microcontroller
  - **Microprocessor**: A CPU on a single integrated chip (IC)
    - The brain of computer
    - E.g.:
      - Intel/AMD's x86
      - ARM's Cortex
    - Contains no RAM, no ROM, no I/O devices



What is Microcontroller?

- Microprocessor vs. Microcontroller
  - **Microcontroller**: A CPU, and RAM, ROM, I/O devices, and timer on a single chip (Also called MCU)
    - "Computer on a chip"
    - Also called **MCU** (Micro-Controller Unit)
    - Usually not as powerful as a general-purpose microprocessor
    - But, **application specific**
      - The operation software ("firmware") is embedded in hardware (ROM)
    - So, low power consumption, small size, low cost



Applications

- Applications of Microcontroller
  - Home
    - TV, Smart phone, Alarm clock, Wireless router …
  - Office
    - Scanner, Printer, Fax machine, Copier,, …
  - Industry
    - Machinery, Equipment, Instrumentation, Rocket, …
- Microcontroller is everywhere, particularly in embedded systems!

Course Contents

- What are we going to learn in this course?
  - We will explore Microcontrollers based on ARM Cortex-M processors
  - Theory classes
    - What are inside a microcontroller?
      - The basic structure of a microcontroller
    - How to program a microcontroller (Firmware)?
      - Assembly language
      - C language
    - How to build a system with a microcontroller?
      - I/O devices
      - Hardware connection
  - Practice Classes
    - Deal with various features of a Cortex-M based microcontroller
    - Developing a robot tracing (somewhat) complex lines