Microcontroller Experiments

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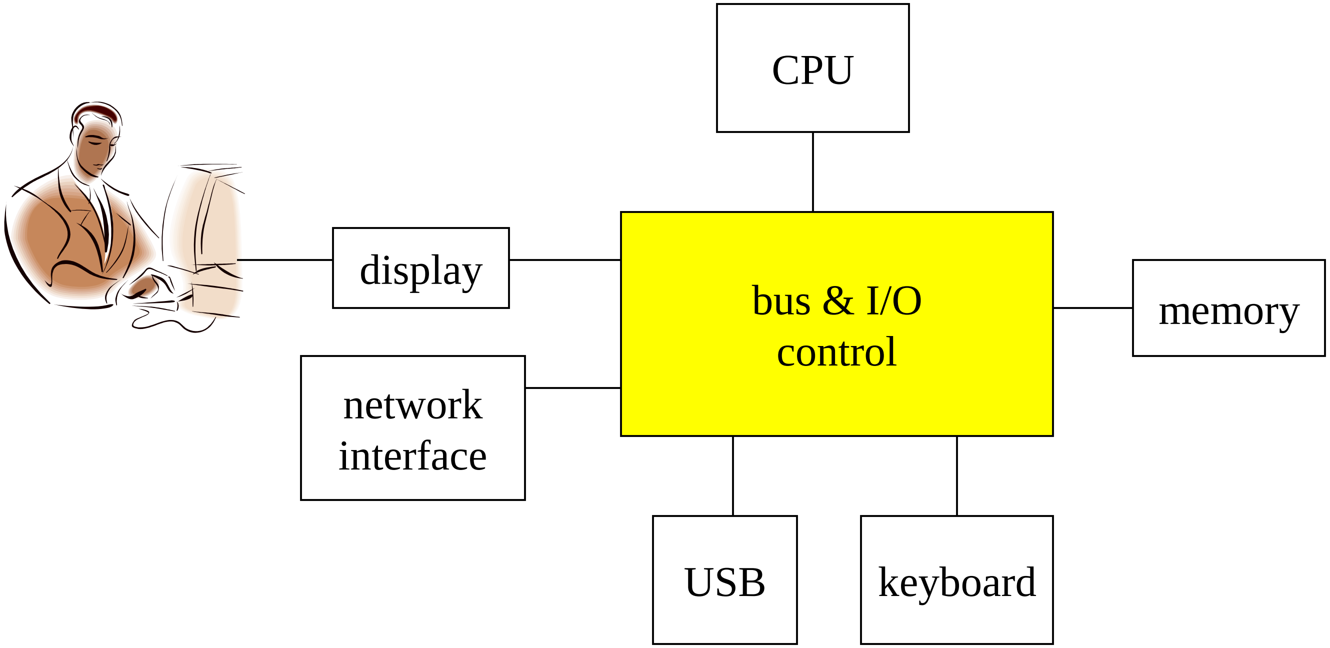
Lab 00: The Course Overview

Syllabus

- Lecturer: Che-Wei Chang <chewei@mail.cgu.edu.tw>
- TAs:高妤蕙<m1429022@cgu.edu.tw>
  李翊瑒<m1429024@cgu.edu.tw>
- Lecture Hours: Thursday 2:10 p.m. – 5:00 p.m.
- Office Hours: Send an email or FB message to me
- Classroom: 數位電路LAB
- Website: https://icechewei.github.io/webpage/teaching.html
- Grading:
  - Pre-lab reports: 20%
  - Lab demo results and reports: 40%
  - Mid-term project: 20%
  - Final term project: 20%
  - We might run a diff program to check your reports and codes: 0 for plagiarism

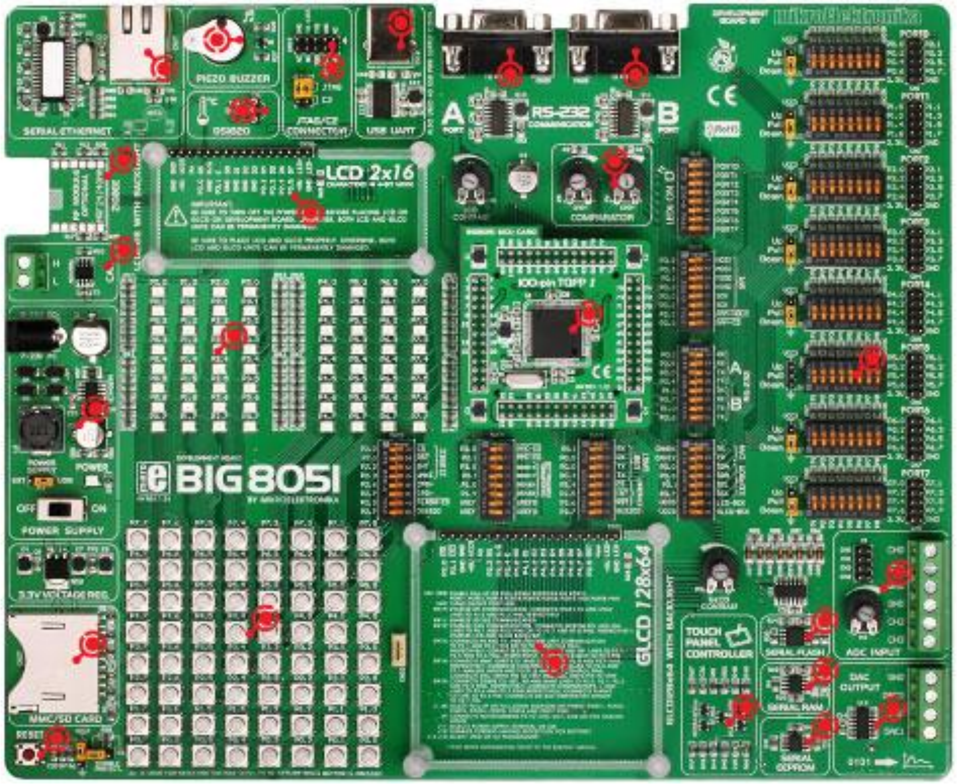
The Objective of this Course

- to learn programming to control I/O devices



Experiment Platform

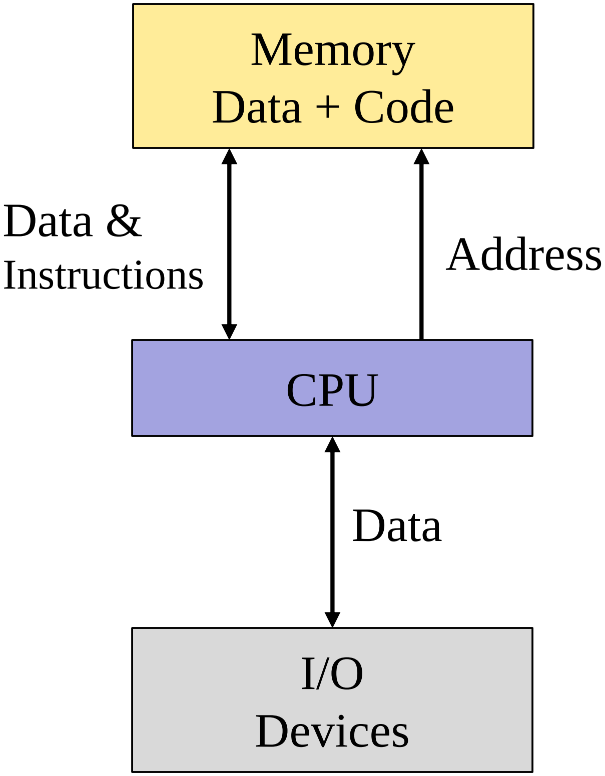
- The BIG8051 experiment board



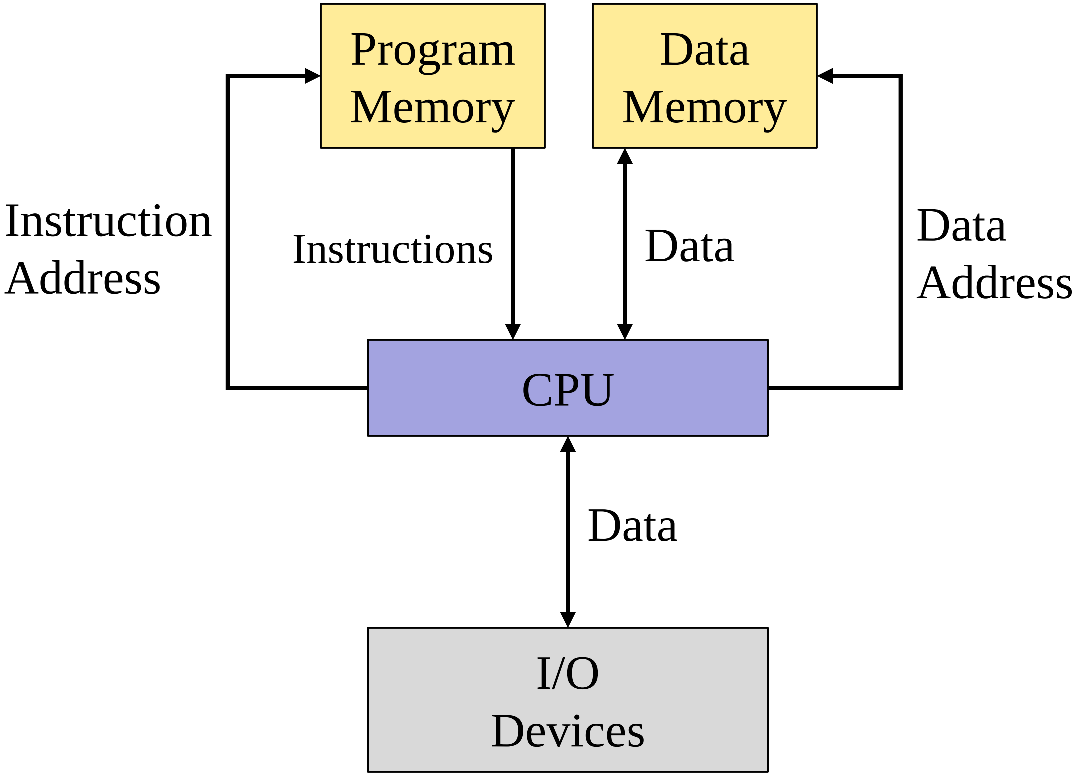
Reference

- Milan Verle, “Architecture and Programming of 8051 Microcontrollers”
  - free on-line book
  - http://www.mikroe.com/en/books/8051book/
- Silicon Lab C8051F04x data-sheet
  - https://www.silabs.com/documents/public/data-sheets/C8051F04x.pdf
- Big8051 schematic
  - https://download.mikroe.com/documents/full-featured-boards/easy/big8051-v6/big8051-manual-v100.pdf

Von Neumann Architecture and Harvard Architecture



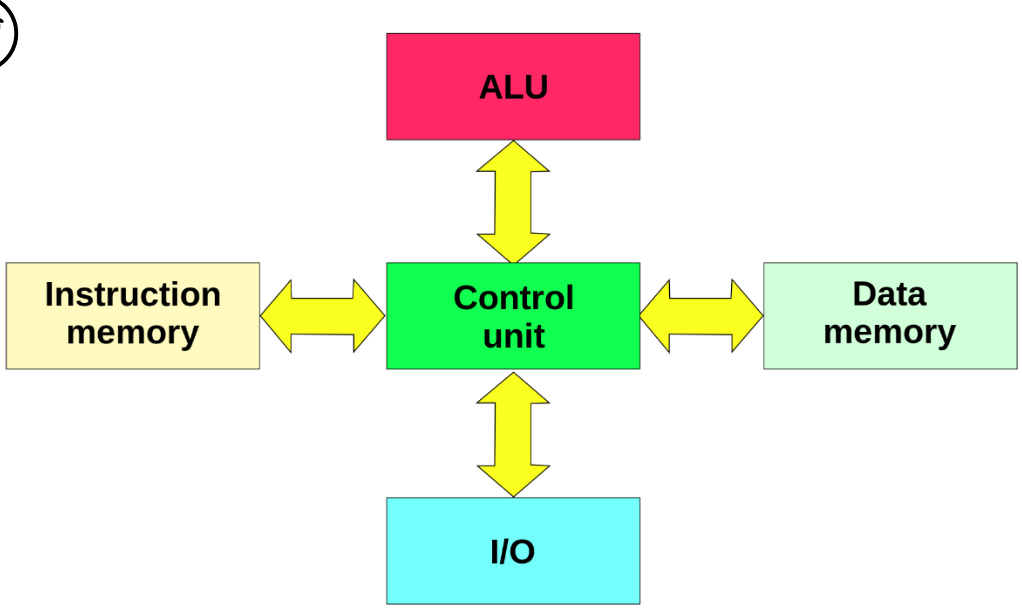
Von Neumann Architecture



Harvard Architecture

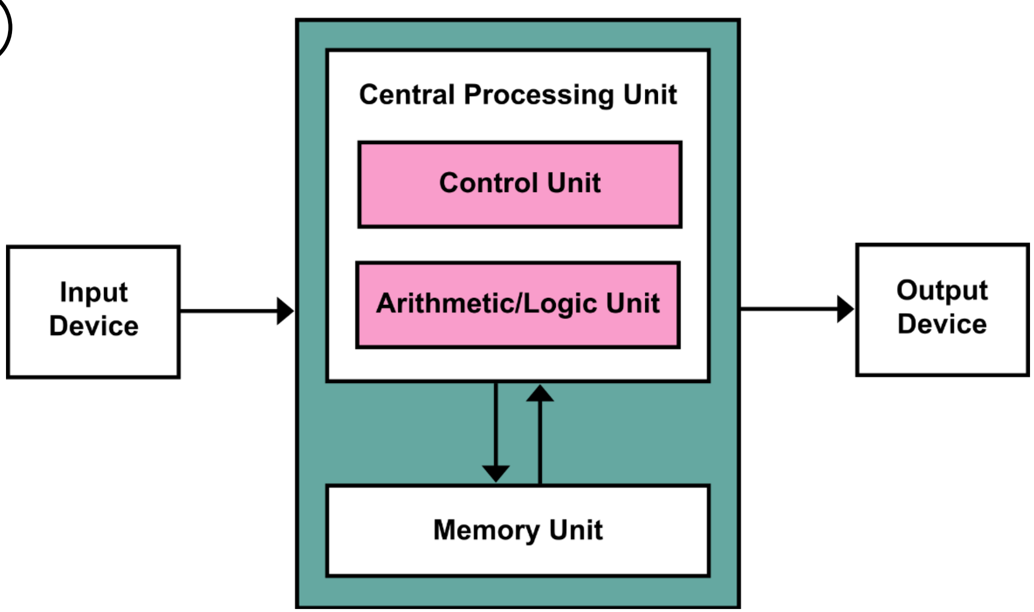
Harvard Architecture

- Speed of execution: ☺
- Hardware requirements: ☹
- Space usage: ☹
- Controlling: ☹



Von Neumann Architecture

- Speed of execution: ☹
- Hardware requirements: ☺
- Space usage: ☺
- Controlling: ☺



Lab00 Study Report

- File name: Bxxxxxxx-MCE-Lab0-Study
- File type: PDF only
- Reading the on-line ebook:
  - https://www.mikroe.com/ebooks/architecture-and-programming-of-8051-mcus
- The scope of reading
  - Form: 1.1 What are microcontrollers and what are they used for?
  - To: 2.6 Counters and Timers (including 2.6)
- The requirements of report
  - List 3 advantages of using 8051
  - List at least 3 techniques you have learned from the ebook
  - Summarize your reading
  - No more than one A4 page (one more page if you have done the bonus)
  - Grading: 80 ± 15
- Deadline: 2025/09/17 23:00 (不收遲交)
- Upload to e-learning system
- Bonus: reading the remaining part of the ebook: + 1~15

What are in 8051 (1/5)

- Read Only Memory (ROM)
  - For permanently saving the program and data
- Random Access Memory (RAM)
  - For temporary storing data and intermediate results created and used during the operations
- Electrically Erasable Programmable ROM (EEPROM)
  - For saving data permanently, but the process of programming is relatively slow

What are in 8051 (2/5)

- Special Function Register (SFR)
  - Special function registers are part of RAM memory
- Program Counter (PC)
  - PC points to the memory address containing the next instruction to execute
- Central Processor Unit (CPU)
  - Instruction Decoder
  - Arithmetical Logical Unit (ALU)
  - Accumulator

What are in 8051 (3/5)

- Input/Output Port
  - Each microcontroller has one or more registers (called a port) connected to the microcontroller pins
- Oscillator
  - An oscillator generates pulses for the cycles
  - Program instructions are not executed at the rate imposed by the oscillator itself, but several times slower

What are in 8051 (4/5)

- Timers/Counters
  - For measuring the time
  - Work with interrupts
- Watchdog Timer
  - When a watchdog timer complete its countdown, it will reset the system
  - Programs should reset the watchdog timer when the programs run normally

What are in 8051 (5/5)

- Power Supply Circuit
  - It converts electric current from a source to the target voltage and current (and frequency) to power the device
- Your Programs!
  - mov 30h,#48
    - Write 48 (decimal) to the register with address 30h (hexadecimal)
  - mov R0,30h
    - Write the number in the register with address 30h to register R0
  - mov A,@R0
    - Find the register with the address stored in R0 and write the number in the register to register A