

Embedded Systems

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- A computer system embedded into another system
 - Constraints from external input/output
 - Application-specific
 - * Diverse set of application areas
- Abstraction
 - Productivity enhancer — don't need to worry about details...
 - * A car can be driven without the knowledge of how an internal combustion engine works
 - ...until something goes wrong
 - * Where's the dipstick? What's a spark plug? Am I out of gas?
 - Important to understand the components and how they work together
- Hardware vs. Software
 - All computers, given enough time and memory, are capable of computing the same exact things
 - In theory, computers “compute” anything that's possible to compute
 - * Given enough memory and time
 - In practice, “solving problems” involves computing under constraints
 - * Time
 - Weather forecast, next frame animation, ...
 - * Cost
 - iPod, automotive engine controller, ...
 - * Power

· Smartphone, tablet, ...

- Layers of Abstraction

Problems
Algorithms
Language
Instruction Set Architecture
Microarchitecture
Circuits
Devices

- Problem Statement
 - * Stated using “natural language”
 - * May be ambiguous, imprecise
- Algorithm
 - * Step-by-step procedure, recipe, guaranteed to finish
 - * Definiteness, effective computability, finiteness
- Program
 - * Express the algorithm using a computer language
 - * High-level language, low-level language
- Instruction Set Architecture (ISA)
 - * Specifies the set of instructions the computer can perform
 - * Data types, addressing mode, hardware/software interface
- Microarchitecture
 - * Detailed organization of a processor implementation
 - * Different implementations of a single ISA
- Logic Circuits
 - * Combine basic operations to realize microarchitecture
- Problem to algorithm is solved by software design, algorithm to program through programming, and program to instruction set architecture through compilation/interpretation
- Instruction set architecture to microarchitecture is solved through processor design, microarchitecture to a circuit is solved through logic/circuit design, and a circuit to a device is solved through the engineering process and fabrication

- Basic Building Blocks

- Electrons
- Transistors

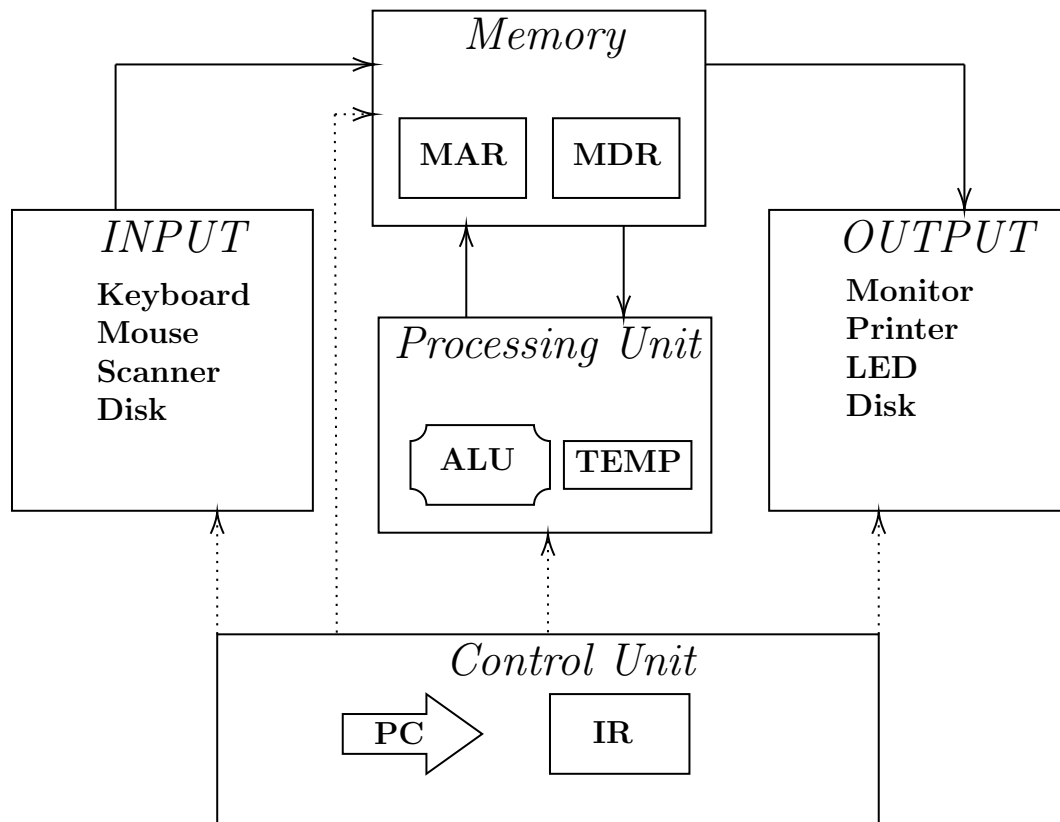


Figure 1: Processing System Flowchart

- Logic Gates
- Combinational Logic Circuits
- Sequential Logic Circuits
 - * Storage Elements and Memory
- Cores
- Memories
- Caches