

EMBEDDED SYSTEM COURSE

LECTURE 1: GETTING STARTED

Learning Goals

- Understanding about the embedded system and its products in real world
- Understanding about the microcontroller: a microprocessor and common architectures nowadays.

Table of contents

1. Embedded system Introduction
2. Microcontroller & Microprocessor
3. Processor Architecture
4. Instruction Set Architecture
5. Summary

Table of contents

1. Embedded system Introduction
2. Microcontroller & Microprocessor
3. Processor Architecture
4. Instruction Set Architecture
5. Summary

Embedded system Introduction

Definition



Embedded System =
Computers Inside a Product



Embedded system Introduction

Definition

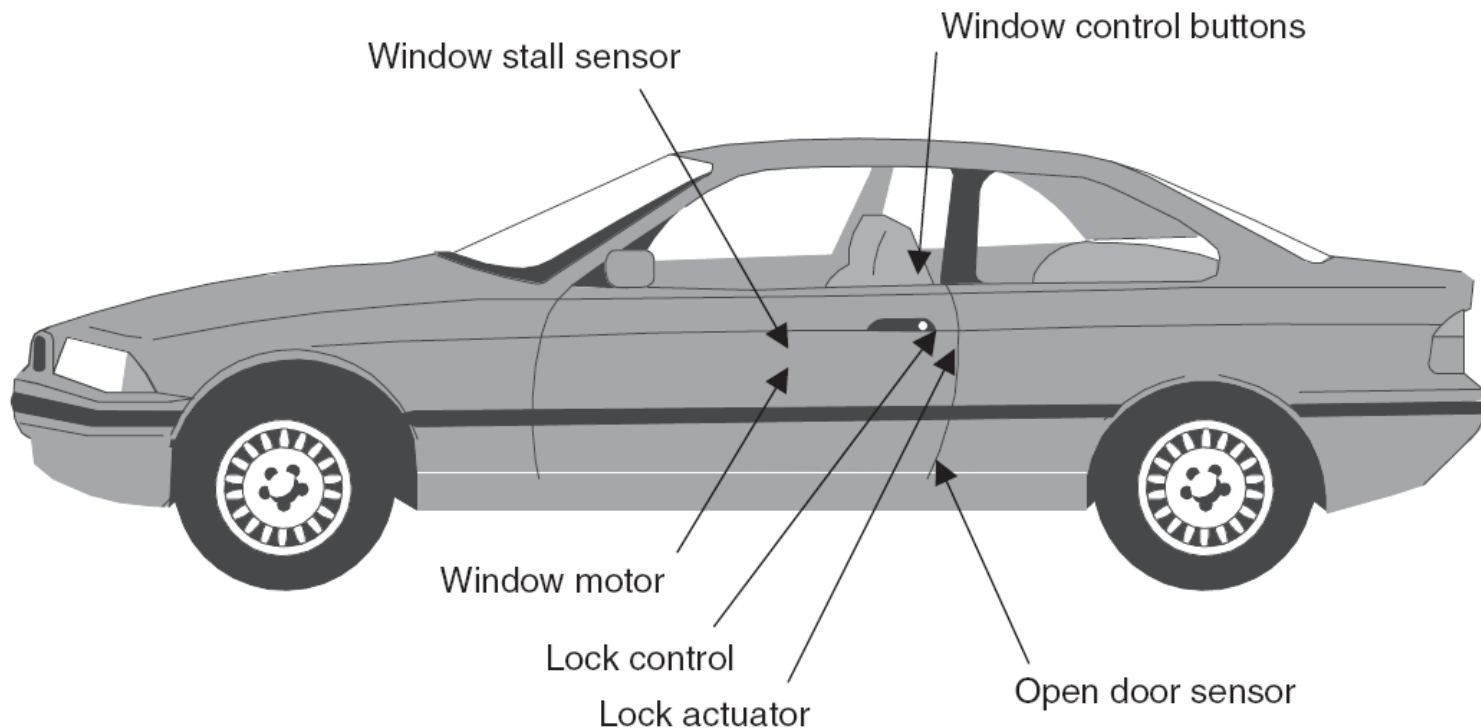
- An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts.

(wikipedia)

Embedded system Introduction

Example:

Embedded system used in Car Door



Embedded system Introduction

Application Area

- General Computing
Video games, set-top boxes, wearable computer
- Control System
Vehicle engine, nuclear power, fight control
- Signal Processing
Radar, Sonar, video compression.
- Communication & Network
Telephone system, router



Embedded system Introduction

Features:

- Embedded system is designed to perform some specific tasks.
- The program written for embedded system is called “firm-ware”, and usually stored in persistence memory (rom/flash)
- The firm-ware can run with limited hardware resourced.

Table of contents

1. Embedded system Introduction
- 2. Microcontroller & Microprocessor**
3. Processor Architecture
4. Instruction Set Architecture
5. Summary

Microprocessors and Microcontrollers

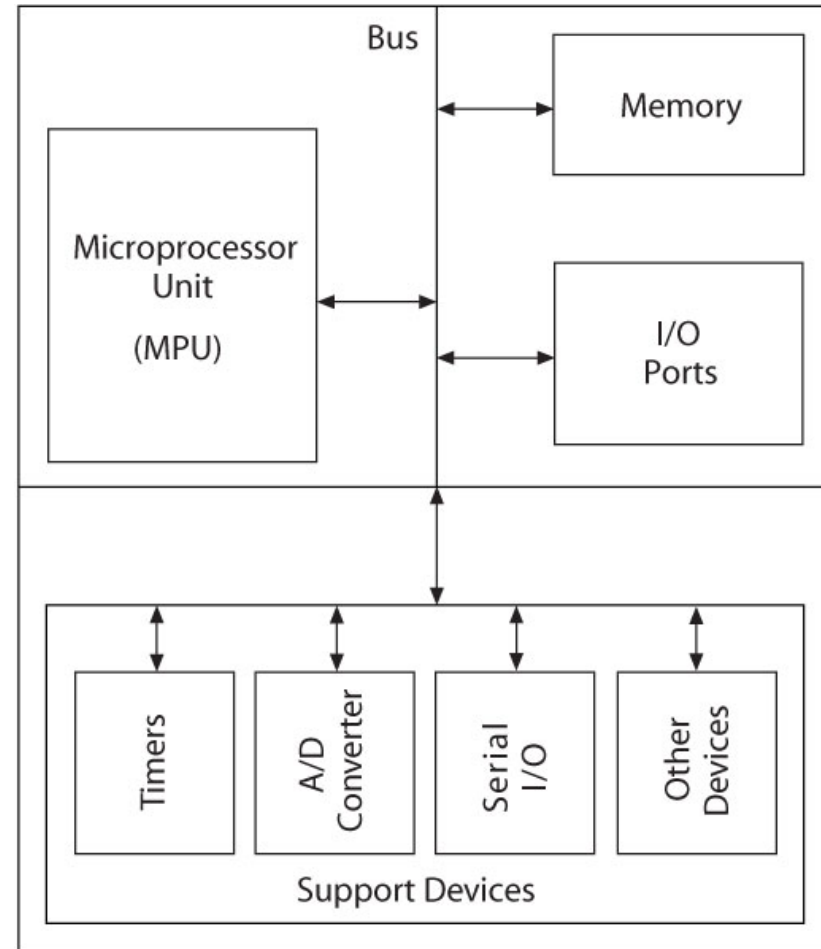
- The microprocessor is a processor on one silicon chip.
- The microcontrollers are used in embedded computing.
- The microcontroller is a microprocessor with added circuitry.

Microcontroller overview

- **Definition**

MCU is integrated electronic computing device that includes three major components on a single chip:

- Microprocessor
- Memory
- I/O ports



Microprocessor overview

- Definition**

The microprocessor is a multipurpose, programmable device that accepts digital data as input, processes it according to instructions stored in its memory, and provides results as output.

(Wiki)

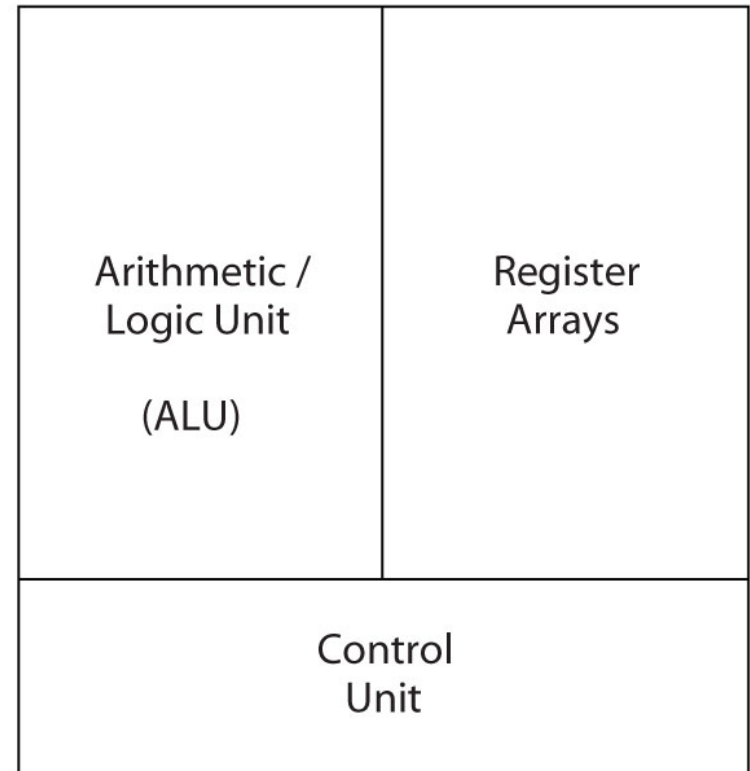


Table of contents

1. Embedded system Introduction
2. Microcontroller & Microprocessor
- 3. Processor Architecture**
4. Instruction Set Architecture
5. Summary

Microprocessor architecture

- Communicates with Memory and I/O using the System Bus:

Address bus

- Unidirectional
- Memory and I/O Addresses

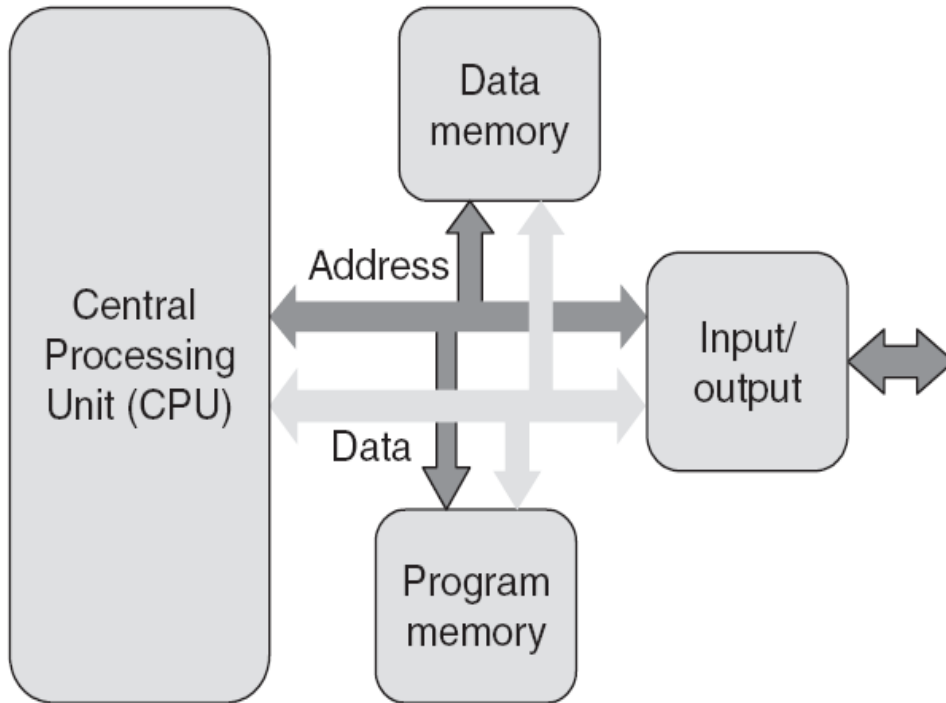
Data bus

- Bidirectional
- Transfers Binary Data and Instructions

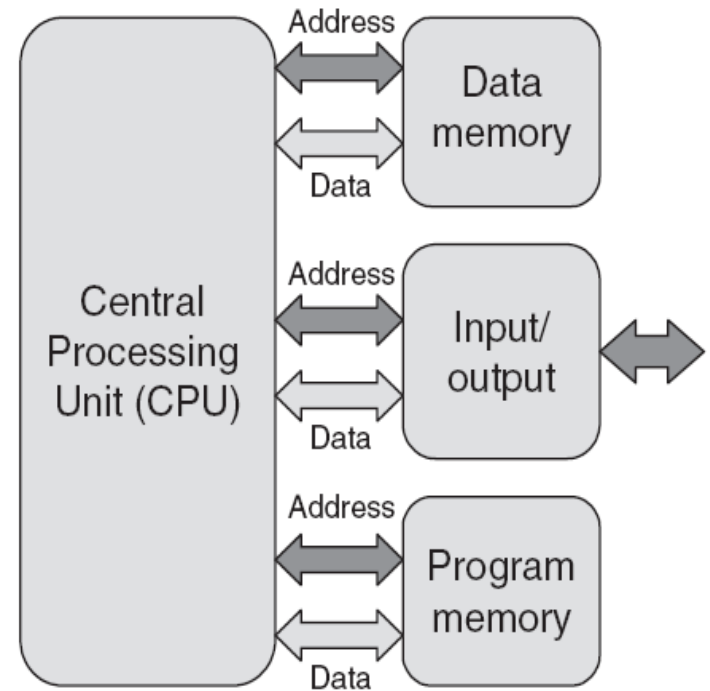
Control lines

- Read and Write timing signals

Microprocessor architecture



Von Neumann



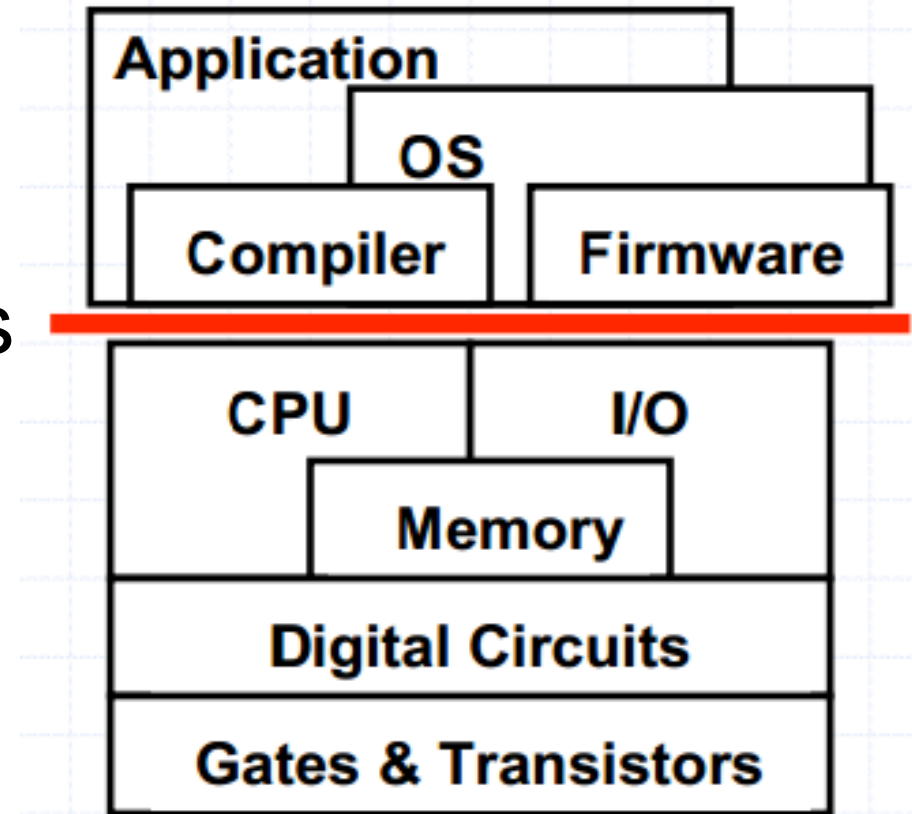
Harvard

Table of contents

1. Embedded system Introduction
2. Microcontroller & Microprocessor
3. Processor Architecture
- 4. Instruction Set Architecture**
5. Summary

Instruction Set Architecture

How to talk to computers



Instruction Set Architecture

- **Definition**

ISA is the part of the computer architecture related to programming, including the native data types, instructions, registers, addressing modes, memory architecture, interrupt and exception handling, and external I/O.

(wiki)

How to design ISA

1. Operations

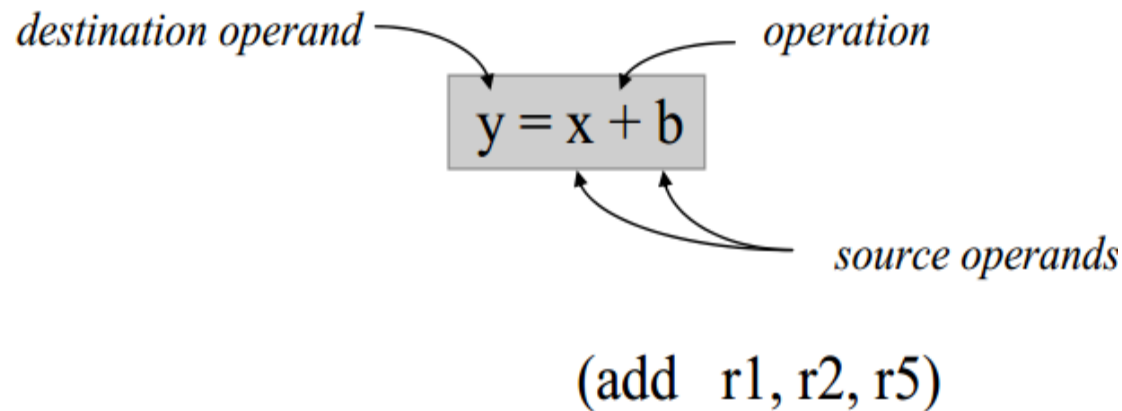
- how many
- which ones

2. Operands

- how many
- location
- types
- how to specify

3. Instruction format

- size
- how many formats



CISC & RISC

CISC

- Fewer instructions to execute a given task than RISC
- Programs for CISC take less storage space than programs for RISC
- Arithmetic or other instructions may read their operand from memory and could write the result in memory

RISC

- Simpler instructions, faster execution speeds per instruction
- Cheaper to implement
- Load/Store architecture – only load and store are used to access the external memory

Summary

- An embedded system is a product that has one or more computers embedded within it.
- The embedded computer is usually a microcontroller: a microprocessor adapted for embedded control applications.
- There are two kinds of microprocessor architectures: Harvard & Von Neumann
- The ISA serves as the boundary between software and hardware

Question & Answer



Thanks for attention !

Copyright

- This course including **Lecture Presentations, Quiz, Mock Project, Syllabus, Assignments, Answers** are copyright by **FPT Software Corporation**.
- This course also uses some information from external sources and non-confidential training document from Freescale, those materials comply with the original source licenses.