Al-Mustaqbal University

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Department of Medical Instrumentation Techniques Engineering

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INTRODUCTION TO MICROPROCESSORS AND MICROCOMPUTERS

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Definition of a Microprocessor

A microprocessor is an electronic chip that contains the central processing unit (CPU) responsible for executing calculations and controlling other components within a system. It acts as the "brain" of a computer, processing data and executing instructions.

History of the Microprocessor

- **First Microprocessor**: The first commercially available microprocessor, the **Intel 4004**, was developed in **1971**. It was a 4-bit processor designed for basic data processing.
- **Technological Evolution**: Following the 4004, more advanced processors emerged, such as the **Intel 8008** (1972) and **Intel 8080** (1974), contributing to the development of personal computers.

Types of Microprocessors

1. **General-Purpose Processors**:
    - Examples include Intel and AMD processors used in desktops and laptops.

2. **Embedded Processors**

    - Used in specialized devices like home appliances, control systems, and medical devices.
2. **Digital Signal Processors (DSP)**
    - Used for processing audio and visual signals, commonly found in mobile phones and audio devices.
3. **Multi-Core Processors**:
    - These contain multiple cores within the same chip, allowing for more efficient multitasking.
4. **Graphics Processing Units (GPUs)**:
    - Specialized for graphics rendering and complex computations, such as those produced by NVIDIA and AMD Radeon

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Applications

- **Personal Computers**: Where the microprocessor executes software and provides user interfaces.
- **Mobile Devices**: Such as smartphones and tablets.
- **Smart Appliances**: Like smart refrigerators and home security devices.
- **Industrial Applications**: In automation and control systems.

The Processor Consists Of

A microprocessor, often referred to as a CPU (Central Processing Unit), consists of several key components that work together to execute instructions and process data. Here's a breakdown of its main components:

1. Arithmetic Logic Unit (ALU)

- Performs arithmetic operations (such as addition and subtraction) and logical operations (such as AND and OR).

2. Control Unit (CU)

- Manages the flow of data within the processor and interprets instructions, directing the ALU and other components to operate according to commands.

3. Registers

- Small, fast memory locations within the processor used to temporarily store data, such as intermediate results of instructions.

4. Cache Memory

- Used to store frequently accessed data and instructions, improving processor performance by reducing access time to the main memory.

5. Buses

- Communication pathways that transfer data between different parts of the microprocessor, including data, address, and control buses.

6. Input/Output Units (I/O Units)

- Manage communication between the processor and external devices, such as keyboards and displays.

7. Internal Logic

- Includes the circuits that organize operations within the processor, such as timing circuits and other logical circuits

CLASSIFICATION OF MICROPROCESSORS:

Based on their specification, application and architecture microprocessors are classified. Based on size of data bus

- 4-bit microprocessor
- 8-bit microprocessor
- 16-bit microprocessor
- 32-bit microprocessor

The processor consists of two parts:

1- Software: Software consists of three modules:

A- The control and transfer unit is responsible for exchanging information between the parts of the processor itself.

b- The bus communication unit is responsible for exchanging information between the processor and other parts of the computer.

c- The arithmetic and logic unit, which is responsible for processing digital data.

2 – hardware

Fig.1 CPU (control processing unit)

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