College of Science

Department of Biochemistry

Lecture: (2)

Computer Hardware components

Subject: Computer Science
Level: First
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Introduction

Computer systems consist of three components: **Central Processing Unit (CPU)**, **Input devices** and **Output devices**. Input devices provide data to the processor (processing unit), which processes it and generates useful information that's displayed to the user through output devices. Output devices are used to show the processed data to the user on computer screen or in print form. Below figure depicts the major hardware components of computer systems.
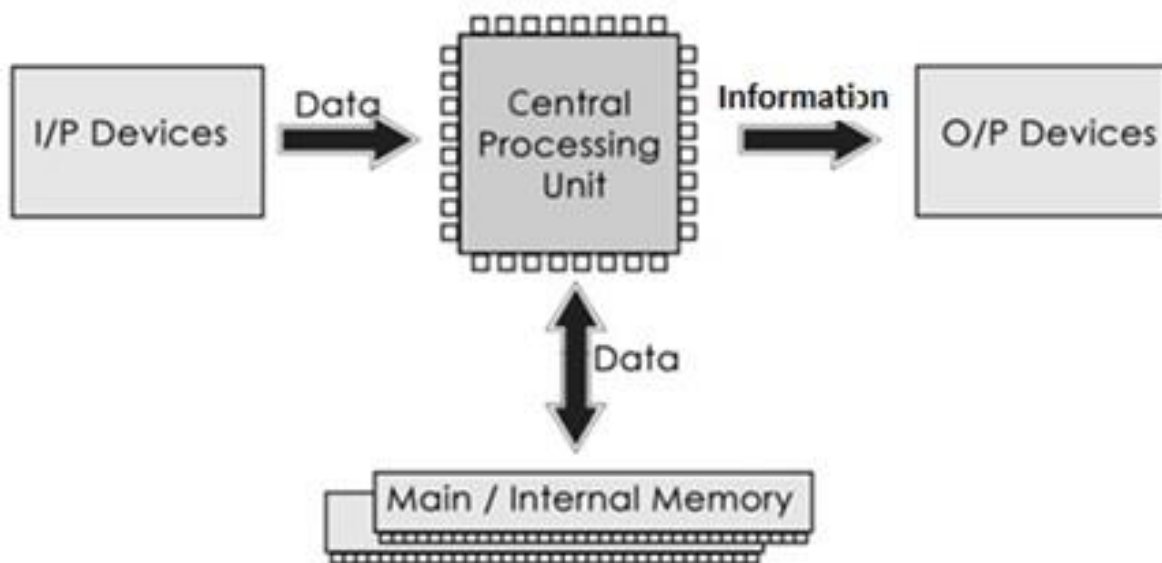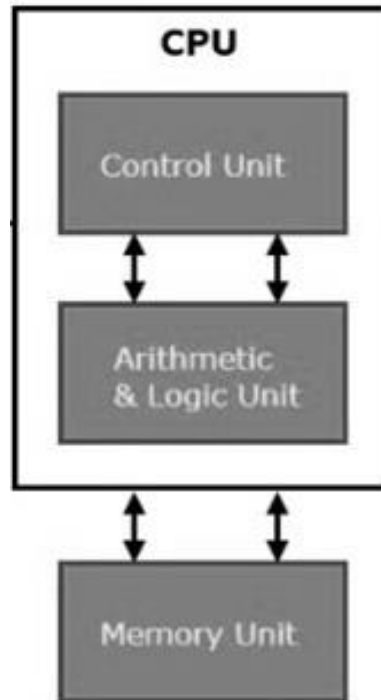
Block diagram of computer
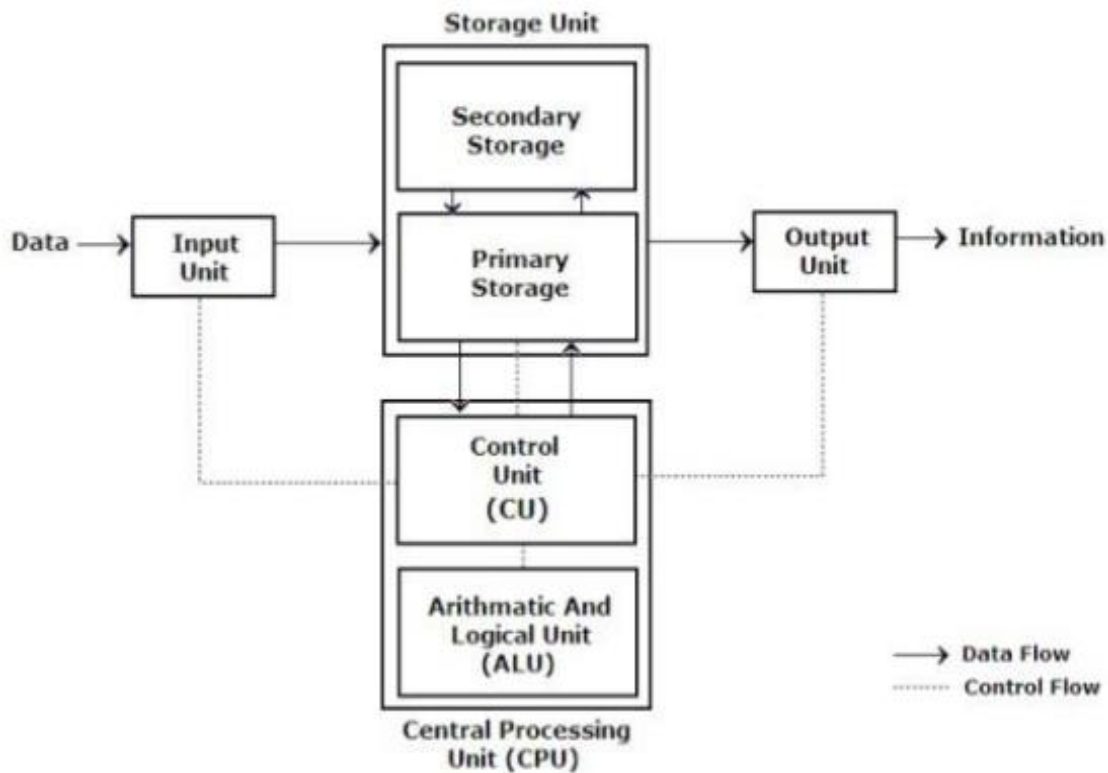
Central Processing Unit (CPU)

The Central Processing Unit (CPU) is also known as "the brain of computer". It controls operation of all components of a computer.

CPU itself has **three components** which are as follows:

- Control Unit (CU)
- ALU (Arithmetic Logic Unit)
- Memory or Storage Unit

Control Unit

The control unit acts as the "brain" of the CPU. It executes instructions and manages the flow of data inside the CPU to perform the tasks specified by a computer program. It plays a pivotal role in the fetch-decode-execute cycle, which is a fundamental process by which a CPU runs program instructions.

Functions of Control Unit

1. **Instruction Fetch** − To run and execute a program; a CU fetches instructions from RAM (Random Access Memory).
2. **Instruction Decoding** − It decodes the fetched instructions to determine the operation to be performed.
3. **Instruction Execution** − A CU executes the instructions by sending control signals to the appropriate functional units within the CPU, such as the ALU for arithmetic and logical operations

4. **Control Flow Management** − The Control Unit is responsible for overseeing the control flow of the program. It accomplishes this by updating the program counter, which enables the CPU to go to the subsequent instruction in the sequence based on conditional statements or jumps.
5. **Exception Handling** − The system effectively manages exceptions and interruptions, including hardware failures, system calls, and external events, by appropriately diverting the control flow of the central processing unit (CPU) to the planned procedure for managing such exceptions.

Arithmetic Logic Unit (ALU)

The Arithmetic Logic Unit (ALU) is a component that has been extensively optimized and engineered to do multiple tasks concurrently. It is commonly built to execute operations speedily. It works in conjunction with other CPU components, such as registers, memory, and control units, to execute complex instructions.

Functions of an ALU

- **Arithmetic Operations** − The ALU can perform basic arithmetic operations such as addition, subtraction, multiplication, and division.
- **Logic Operations** − The ALU can also perform logical operations like AND, OR, NOT, XOR, and bit-shifting operations.
- **Comparison** − The ALU can compare two binary values and determine whether they are equal, greater than, or less than each other. This function is most widely used in programming and sorting algorithms.

Memory Unit

A memory or storage unit is a hardware component which is used to store the data and instructions and retrieve it whenever is required. Majorly computer memory has categorized as temporary (**RAM**) and permanent memory (**secondary memory**). RAM is used for short-term, fast data access and essential for active program execution. On the other hand, storage or secondary memory provides permanent data

storage. Hence, memory and storage units both are critical components of a computer system.

Memory (RAM - Random Access Memory)

- RAM is also known as primary or temporary memory; it is a type of volatile memory used for temporarily storing data.
- The contents inside the RAM are erased when computer's power get off or restarted.
- RAM is actively used for program or instructions execution.
- Once we start the computer; systems necessary files, programs and the operating system files are loaded into the RAM for smoothly running of computer.
- The more RAM a computer has, the better it can handle multitasking and the faster it can run applications since data can be accessed more quickly.

Storage (Hard Drives, SSDs, Flash Drives, etc.)

- Storage devices are used to store the data permanently, even when the computer is powered off.
- They are non-volatile in nature; the data remains intact even when the power is get off or system restarts.

- The most popular and commonly used storage devices are Hard Disk (HDs), Solid-State Drives (SSDs), USB flash drives, and optical disks (e.g., DVDs), pen drives.
- The data storage capacity varies of these devices are in gigabytes (GB) to terabytes (TB) and more, depending on the type and size of the storage device.
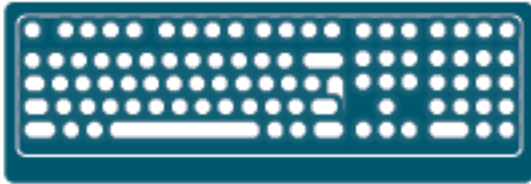

Input Devices

The devices which are used to give input to the computer system is known as input devices.

INPUT DEVICES

KEYBOARD   MOUSE   JOYSTICK

SCANNER   WEB CAMERA   MICROPHONE

Keyboard

Keyboard is a most common and very popular input device which helps to input data to the computer. The layout of the keyboard is like a traditional typewriter, although there are some additional keys provided for performing additional functions. There are different types of keyboards; each one has designed for specific purposes.

- **QWERTY Keyboards** − QWERTY is a most usable keyboard. It's named after the first six letters in the top row of the keyboard.

- **Mechanical Keyboards** − Each key on mechanical keyboards has a mechanical switch. Different types of switches offer varying levels of tactile feedback and actuation force.

- **Membrane Keyboards** − Laptops and cheap desktop keyboards have membrane keyboards. When pushed, a key contacts a rubber or silicone membrane below the keys to register a keystroke.

- **Ergonomic Keyboards** − Typing for long periods of time can cause muscle strain and discomfort; ergonomic keyboards are specifically designed to alleviate these issues.

- **Gaming Keyboards** − Gaming keyboards are optimized for gaming performance. They usually have changeable illumination, programmable keys, and anti-ghosting technology to prevent missed keypresses during fast gameplay. Some gaming keyboards include mechanical switches for quicker responsiveness.

- **Wireless Keyboards** − Wireless keyboards use Bluetooth or RF to connect to computers and other devices without cords. Laptops, tablets, and smart TVs utilize them for convenience and mobility.

- **Virtual Keyboards** − Software-based virtual keyboards are utilised on smartphones and tablets. Tap or swipe virtual keys to enter text or directions.

- **Foldable Keyboards** − Foldable keyboards are portable and convenient. Travellers and people who require a small keyboard may fold or wrap them up for storage and transport.

Mouse

Mouse is a most popular input device. It is also known as a pointing device. It is a very famous cursor-control device having a small palm size box with a round ball at its base, which senses the movement of the mouse and sends corresponding signals to the CPU when the mouse buttons are pressed. Generally, it has two buttons called the left and the right button and a wheel is present between the buttons. A mouse can be used to control the position of the cursor on the screen, but it cannot be used to enter text into the computer.

The most common types of mouse are as follows −

- **Optical Mouse** − Movement is detected by LED lights and sensors in optical mouse. They work on many surfaces and are the most common mouse.

- **Trackball Mouse** − Trackball mice have a stationary ball on top that users may roll with their fingers or thumbs.

Movement controls the screen cursor. Trackball mice are utilised when space or accuracy are restricted.

- **Wireless Mouse** − Bluetooth or USB receivers link wireless mice to computers and devices. They're cable-free, so they move more freely.

Wireless mouse can be recharged or utilise disposable batteries.

- **Wired Mouse** − They work without batteries or a wireless connection, making them a good solution for those who don't want to worry about signal interference. These are connected to computers using physical cables.

- **Gaming Mouse** − Gaming mouse have configurable buttons, adjustable DPI, and ergonomic ergonomics for long-term usage. Gaming is optimised for rapid, accurate movements.

Joystick

Joystick is also a pointing device, which is used to move the cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The joystick can be moved in all four directions.

The function of the joystick is similar to that of a mouse. It is mainly used in Computer Aided Designing (CAD) and playing computer games.

Light Pen

Light pen is a pointing device similar to a pen. It is used to select a displayed menu item or draw pictures on the monitor screen. It consists of a photocell and an optical system placed in a small tube.

When the tip of a light pen is moved over the monitor screen and the pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.

Scanner

Scanner is an input device, which works more like a photocopy machine. It is used when some information is available on paper and it is to be transferred to the hard disk of the computer for further manipulation.

Scanner captures images from the source which are then converted into a digital form that can be stored on the disk. These images can be edited before they are printed.

Microphone

Microphone is an input device to input sound that is then stored in a digital form.

The microphone is used for various applications such as adding sound to a multimedia presentation or for mixing music.

Bar Code Readers

Bar Code Reader is a device used for reading bar coded data (data in the form of light and dark lines). Bar coded data is generally used in labelling goods, numbering the books, etc. It may be a handheld scanner or may be embedded in a stationary scanner.

Bar Code Reader scans a bar code image, converts it into an alphanumeric value, which is then fed to the computer that the bar code reader is connected to.

Output Devices

Common Output Devices of Computer

Following are some of the important output devices used in a computer.

- Monitors
- Graphic Plotter
- Printer

Monitors

Monitors, commonly called as Visual Display Unit (VDU), are the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels.

There are two kinds of viewing screen used for monitors.

- Cathode-Ray Tube (CRT)
- Flat-Panel Display

Cathode-Ray Tube (CRT) Monitor

The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity or resolution. It takes more than one illuminated pixel to form a whole character, such as the letter 'e' in the word help.

A finite number of characters can be displayed on a screen at once. The screen can be divided into a series of character boxes - fixed location on the screen where a standard character can be placed. Most screens are capable of displaying 80 characters of data horizontally and 25 lines vertically.

Flat-Panel Display Monitor

The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT. You can hang them on walls or wear them on your wrists. Current uses of flat-panel displays include calculators, video games, monitors, laptop computer, and graphics display.

Graphic Plotter

Computer graphics and engineering applications employ graphic plotters to create high-quality, accurate, and detailed drawings or plots on paper or other media. It draws continuous lines accurately and is suited for vector drawings, unlike a standard printer. Key features of graphic plotters are as −

Printers

Printer is an output device, which is used to print information on paper.