1.2 - Computer Hardware Components.

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The physical parts of a computer system are known as computer hardware, which include the following units:

1. **Input Unit**
2. **Memory Unit**
3. **Arithmetic & Logic Unit (ALU)**
4. **Control Unit (CU)**
5. **Output Unit**

Study of Different Components of Computer Hardware

Understanding computer hardware involves examining various components that work together to make a computer functional. Each component plays a unique role in the system.

1. Central Processing Unit (CPU)

- **Role**: The CPU is often referred to as the "brain" of the computer. It executes instructions and performs calculations.
- **Function**: It interprets and processes commands from computer programs.
- **Advancements**: Over time, CPUs have improved in speed, architecture, and efficiency.

2. Memory

- **RAM (Random Access Memory)**: Provides temporary storage for data actively used by the CPU. Enhances speed and responsiveness.
- **Storage**: For long-term data retention. Includes:
  - **Hard Disk Drives (HDDs)**: Traditional storage with moving parts.
  - **Solid-State Drives (SSDs)**: Faster access due to lack of moving parts.

3. Motherboard

- **Role**: Serves as the central hub connecting various hardware components.

- **Components**: Houses the CPU, memory modules, and other peripherals.
- **Expansion**: Expansion slots allow for adding components like graphics cards, sound cards, and networking cards.

4. Graphics Processing Unit (GPU)

- **Role**: Dedicated to rendering images and videos.
- **Uses**: Initially for graphic-intensive tasks; now also used in parallel computing for AI and scientific simulations.
- **Integrated Graphics**: Found in many CPUs, providing basic graphical capabilities.

5. Input and Output Devices

- **Input Devices**: Allow users to interact with the computer. Includes:
  - **Keyboard** ○ **Mouse**
- **Output Devices**: Display or produce results from the computer. Includes:
  - **Monitor** ○ **Printer**
  - **Advancements**: Touchscreens, virtual reality interfaces.

6. Networking Components

- **Network Interface Cards (NICs)**: Facilitate wired or wireless connectivity, allowing data exchange over a network.
- **Routers and Switches**: Manage data traffic within a network.

7. Power Supply Unit (PSU)

- **Role**: Converts electrical power from an outlet into a form usable by the computer.
- **Importance**: Essential for the stability and longevity of computer systems.

8. Cooling Systems

- **Purpose**: Prevent components from overheating.
- **Components**: Includes fans and heat sinks to dissipate excess heat generated during operation.

Input Devices and Memory

Information is entered into computers via input devices. Examples include:

- **Keyboard**: The standard data input unit with keys arranged in a QWERTY layout, including a numeric keypad and function keys for control.
- **Mouse**: Moves a cursor on the screen. It has two buttons and a scroll ball for navigation and selection.
- **Joystick**: Used primarily for gaming, allowing movement within the screen's environment.
- **Light Pen**: A pointing device modeled like a pen, detecting light from the screen to identify its location.
- **Scanner**: Converts images or text into digital data. Types include flatbed and hand-held scanners.
- **Bar Code Reader**: Reads patterns of lines of varying widths, commonly used for tracking product sales.

2. Memory Unit

Memory in computers stores data and instructions needed for processing. It is categorized into:

- **Primary Memory**: Directly accessible by the CPU, includes:
    - **RAM (Random Access Memory)**: Volatile memory that loses data when power is off. Types:
        - **Dynamic RAM (DRAM)**: Requires refreshing to maintain data.
        - **Static RAM (SRAM)**: Faster and more expensive, retains data without refreshing.
    - **ROM (Read-Only Memory)**: Non-volatile, contains essential system instructions. Types:
        - **PROM (Programmable ROM)**: Data can be written once and read many times.
        - **EPROM (Erasable Programmable ROM)**: Data can be erased and rewritten.
- **Secondary Memory**: Non-volatile and includes:
    - **Hard Disks**: Magnetic storage with larger capacity and permanent storage.
    - **Floppy Disks**: Older storage medium, smaller capacity, and flexible.
    - **Optical Storage Devices**: Includes CD-ROM, DVD-ROM, and CD-RW, using laser technology for reading and writing data.
    - **Pen Drives / Flash Drives**: Portable, solid-state storage devices.
    - **Solid State Drives (SSD)**: Replace hard disks with faster, semiconductor-based storage.

3. Processor Registers

Registers in the CPU are the fastest storage components, used for temporary data holding. Common registers include:

Register	Symbol	Number of Bits	Function
Data Register	DR	16	Holds memory operand
Address Register	AR	12	Holds address for memory
Accumulator	AC	16	Processor register
Instruction Register	IR	16	Holds instruction code
Program Counter	PC	12	Holds address of the instruction
Temporary Register	TR	16	Holds temporary data
Input Register	INPR	8	Carries input character
Output Register	OUTR	8	Carries output character

4. Cache Memory

Cache memory is a faster, smaller memory that stores copies of data from main memory. It is categorized into:

- **L1 Cache**: Primary cache, fastest and built into the CPU.
- **L2 Cache**: Secondary cache, larger than L1, may be on the CPU or a separate chip.
- **L3 Cache**: Tertiary cache, larger and slower compared to L1 and L2.

5. Control Unit

The Control Unit of the CPU directs how the processor interacts with memory, input, and output devices. It processes internal program instructions and manages the execution of commands.

Output Devices

An output device is computer hardware that receives data from a computer and translates that data into text, audio, video, or hard copy, such as a printed document.

The key difference between an input device and an output device is that an input device takes data from the user, while an output device delivers output either on a monitor, printer, or other devices.

Examples of Output Devices:

1. **Monitor**:
    - Displays information in the form of images or text.
    - A discrete monitor includes a visual display, supporting electronics, power supply, electronic connectors, and external user controls.

2. **Printer**:
    - Prints out on paper what you see on the computer screen.
    - Types include inkjet, laser, and dot matrix printers.
3. **Speakers**:
    - Audio output devices that allow you to hear computer sound.
    - They come in different sizes and are often used in pairs.
4. **Headphones**:
    - Also known as earphones, used to listen to music or audio.
    - Can be connected via cables or Bluetooth.
5. **Projector**:
    - Takes video or images from a computer and displays them on a screen, wall, or other surfaces.
    - Used for presentations or large display needs.

Software

Software can be defined as a set of instructions or programs that helps a computer to accomplish a particular task.

Key Points:

- Software generally refers to applications, scripts, or programs running on a device.
- It can be categorized into system software (like operating systems) and application software (like word processors and games).
- Software is essential for performing various functions and tasks on a computer.