

CHAPTER - 2

INPUT/OUTPUT DEVICES AND OTHER HARDWARE

OBJECTIVES OF THIS LESSON

This lesson is aimed to make you understand the basic concepts of peripheral devices as well as important hardware components as under:

- Input/Output concepts
- Input devices
 - *Commonly used input devices such as Keyboards, Mouse, Joysticks, Trackballs, Touch Screens, Light Pens, Touch Pad, Digitizer, Voice Systems and Scanners*
- Output devices
 - *Commonly used output devices such as Monitors, Printers and Plotters*
- Other important hardware such as -
 - Motherboard, RAM, Video Card, Digital storage, Power Supply Unit, Expansion cards, Sound Card, Network card, etc.

STRUCTURE OF THIS LESSON

- 2.1 Introduction
- 2.2 Input Devices
 - 2.2.1 Keyboards
 - 2.2.2 Mouse
 - 2.2.3 Joysticks
 - 2.2.4 Trackballs
 - 2.2.5 Touch Screens
 - 2.2.6 Light Pens
 - 2.2.7 Touch Pad
 - 2.2.8 Digitizer
 - 2.2.9 Voice Systems
 - 2.2.10 Scanners
- 2.3. Output Concepts
- 2.4 Output Devices
 - 2.4.1 Monitors
 - 2.4.2 Printers
 - 2.4.2.1 Types OF Printers
 - 2.4.2.2 Character Printers

- 2.4.2.3 Daisy-Wheel Printer
- 2.4.2.4 Dot-Matrix Printer
- 2.2.4.5 Line Printers
- 2.4.2.6 Page Printers
- 2.4.2.7 Laser Printer
- 2.4.2.8 Inkjet Printer
- 2.4.3 Plotter
 - 2.4.3.1 Drum Plotter
 - 2.4.3.2 Flatbed Plotter
 - 2.4.3.3 The Inkjet Plotter
 - 2.4.3.4 Led Plotter
- 2.4.4 Projector
- 2.5 *Other Hardware*

Remarks

Summary of the Lesson

Self Assessment Questions and Exercises

2.1 INTRODUCTION

A **computer peripheral** is any external device that provides input and output for the computer. For example, a keyboard and mouse are input peripherals, while a monitor and printer are output peripherals. Computer peripherals, or peripheral devices, are sometimes called "I/O devices" because they provide input and output for the computer. Some peripherals, such as external hard drives, provide both input and output for the computer.

2.2 INPUT DEVICES

An **input device** is any hardware device that sends data to the computer, without any input devices, a computer would only be a display device and not allow users to interact with it, much like a TV. Following continuing research in the field of computer hardware, we have a large number of input devices. Recall that before data can be processed by the computer, they must be translated into machine-readable form and entered into the computer by an input device.

Here, we list a variety of input devices:

- **Punched Cards and Card Readers**
- **Keyboards**
- **Joysticks**
- **Trackballs**
- **Mouse**
- **Touch Screens**
- **Light Pens**

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- **Touch Pad**
- **Digitizer**
- **Voice Systems**
- **Key to Magnetic Media**
- **Financial Transaction Terminals**
- **Machine Vision Systems**
- **Source Data Input**
- **Magnetic-ink Character Recognition (MICR)**
- **Magnetic Strips**
- **Optical Recognition**
- **Point-of-Sale Terminals**
- **Barcode reader**
- **Digital camera**
- **Microphone**
- **MIDI keyboard**
- **Mouse (pointing device)**
- **Remote**
- **Scanner**
- *Webcam*

Few popular and commonly used input devices are briefly described below.

2.2.1 Keyboards

A keyboard is one of the today's most common and familiar input device. A keyboard's primary function is to act as an **input device**. The computer **keyboard** is used to enter text information into the computer, as when you type the contents of a report.



Figure 2.1: Keyboards

2.2.2 Mouse

Mouse is a pointing device and it has been around us for more than 20 years. The mouse usually contains one to three buttons; as the user rolls it on a flat surface, the mouse controls cursor movement on the screen. When the user presses one of the buttons, the mouse either marks a place on the screen or makes selections from data on the screen.

Different types of mouse are shown in **Fig. 2.2**.

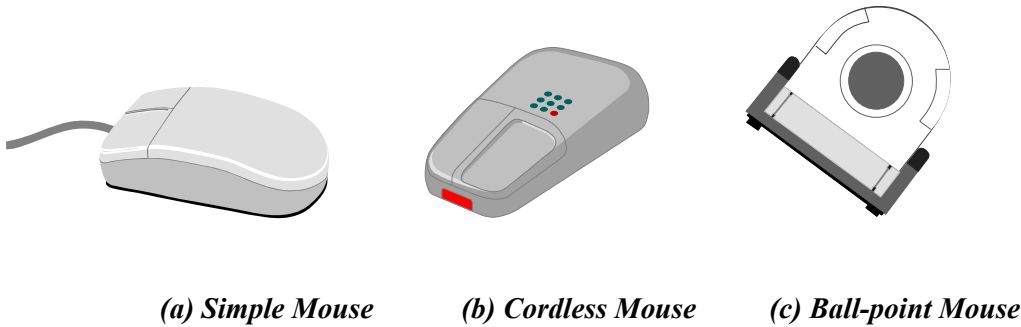


Fig. 2.2: Different Types of Mouse

Advantages

- *It is simple device and very easy to use.*
- *It is not that very expensive.*
- *It moves the cursor faster than the arrow keys of keyboard do.*

Disadvantages

- *The movement of the cursor is not very sensitive to movement of mouse.*
- *If the contact between wheels and mouse pad is lost, the cursor does not move.*

2.2.3 Joysticks

A joystick is also a pointing device. It is used to move the cursor position on a CRT screen. Its function is similar to a mouse, except that with a mouse the cursor stops moving as soon as you stop moving the mouse. A joystick is a stick which has spherical ball at its lower end as well as at its upper end. A joystick uses a lever to control the position of the cursor. It internally translates the lever position and speed with which the joystick is moved into digital signals that are sent to the computer to control the cursor movement. Most joysticks include two buttons called triggers.



Fig. 2.3: Joystick

Joysticks are used for Computer games but they are also used occasionally for CAD/CAM systems and other applications.

2.2.4 Trackballs

Trackball is another pointing device. A trackball is a mouse lying on its back. A trackball uses a hard sphere to control cursor movement. The ball can be rotated by hand in any direction. The associated electronic circuitry detects the direction and speed of spin. The trackball translates the sphere's

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direction and speed of rotation into digital signal used to control the cursor. The information is sent to the CPU for initiating further necessary action.

Different types of Trackball are shown in *Fig. 2.4*.

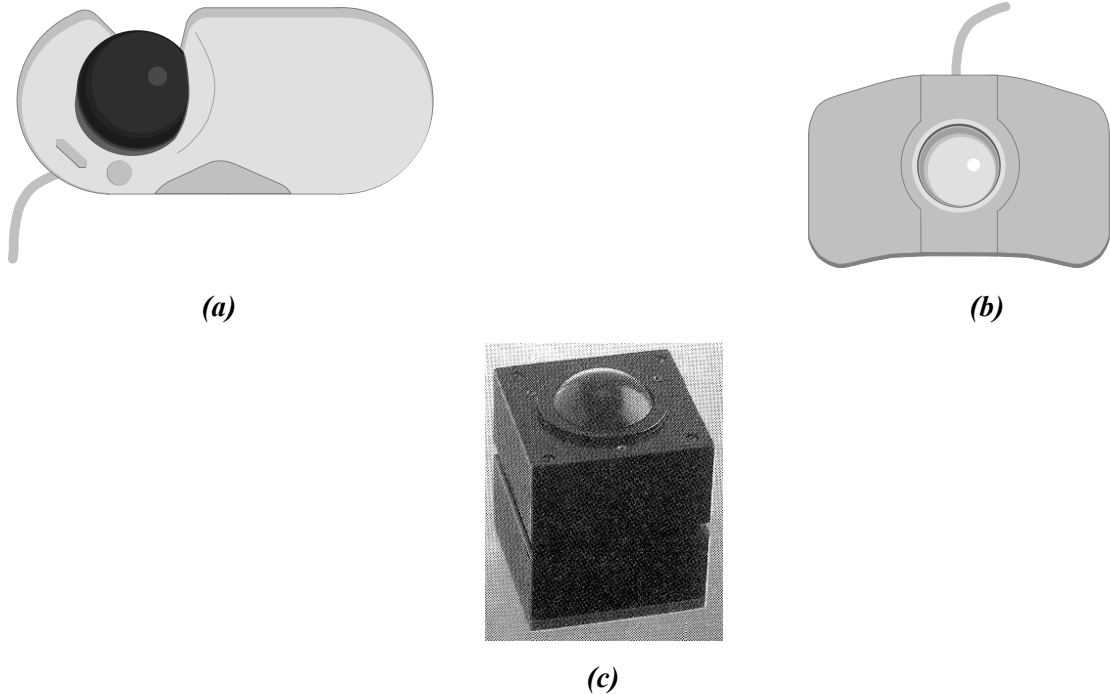


Fig. 2.4: Various Types of Trackballs

2.2.5 Touch Screens

A touch screen is basically a display screen which can identify the occurrence and position of a touch inside the display region. The word normally refers to a touch or tap to the display of the gadget by a finger or hand. Touch screens can also identify added inactive objects, such as a stylus. However, if the object identified is active, as with a light pen, the phrase touch screen is normally irrelevant. The facility to interact directly with a display normally specifies the existence of a touch screen.



Figure 2.5: Touch Screen Monitor

Such touch screen displays can be connected to computers, laptops, PDAs, cell phones etc. They also project an important function in the blueprint of digital.

2.2.6 Light Pens

A light pen is similar to a mouse, except that with a light pen we can move the pointer and select objects on the display screen by directly pointing to the object with the pen. It is a pen like device which is connected to the machine by a cable.

Light pens are shown in *Fig. 2.6*.



Fig. 2.6: Light Pens

2.2.7 Touch Pad

A small, touch-sensitive pad is used as a pointing device on some portable computers. By moving a finger or other object along the pad, we can move the pointer on the display screen. The touch pad is related to the touch screen, but activated by different means. The touch pad uses pressure-sensitive materials to record data at the point where the pad is touched. Many appliances around the home, such as microwave ovens, use touch pads for programming time or temperature.

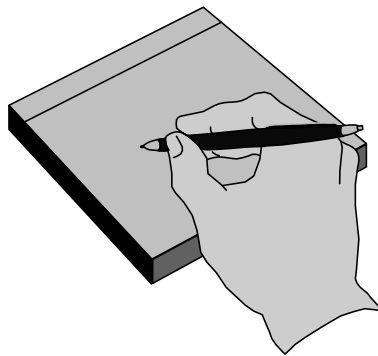


Fig. 2.7: Touch Pad Using a Point-device

2.2.8 Digitizer

A digitizer, or graphics tablet, is similar to a light pen; however, instead of drawing on the screen, a separate tablet is used on which a special stylus is moved. Input tablets or digitizer tablets or graphical tablets are typically found in CAD terminals or engineering workstations, etc.

Digitizers are also called Digitizing Tablets, Graphics Tablets, Touch Tablets, or simply Tablets. Top-view of digitizer along with tablet is shown in *Fig. 2.8*.

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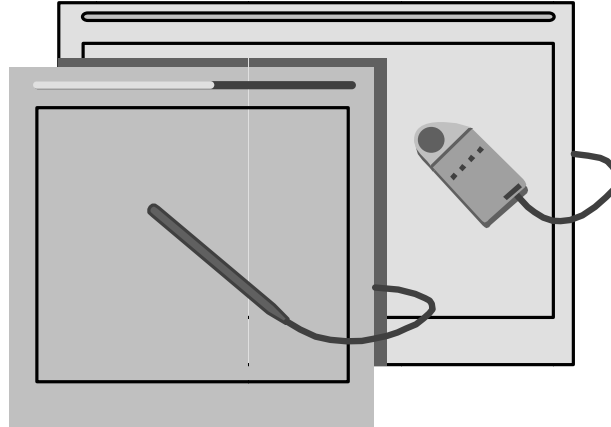


Fig. 2.8: Digitizer With Tablet

2.2.9 Voice Systems

Audio input provides direct and “user friendly” means of inputting data and instructions to the computer. Recently, a number of Voice Data Entry (VDE) systems have been developed. Voice recognition is one of the newest, most complex input techniques used to interact with the computer. The user inputs data by speaking into a microphone.

2.2.10 Scanners

Scanner is a kind of input device that can read text or printed paper and translates the information in a convenient form to be understood by the computer. All kinds of scanned documents using an optical scanner gets converted in the form of bit-map and thus it does not distinguish between text or graphics. In order to edit text read by an optical scanner, we need an OCR system to translate the image into ASCII format. Almost all optical scanners sold today come along with OCR packages.

There are six distinct types of scanners:

- handheld
- flatbed
- sheetfed
- photo drum, and
- slide.

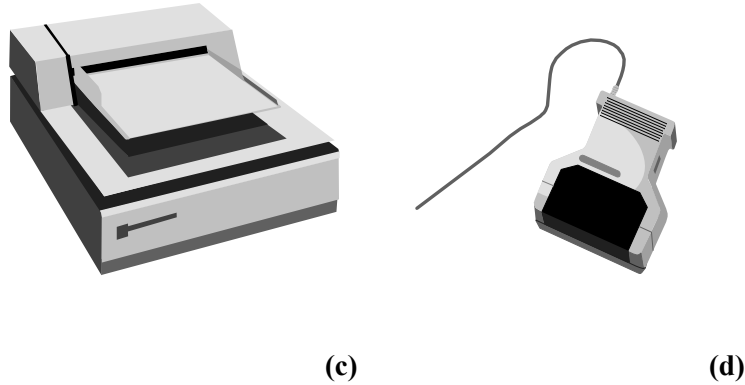
Each of these styles has its own practical applications and limitations. Theoretically, you could also include digital cameras as a type of scanner.

Flatbed (or simple) and Hand-held scanners are the most popular scanners in maximum use. These are shown in *Fig. 2.9 (a)* and *(b)* respectively.



(a)

(b)



(a) to (c) *Flatbed Scanners* (d) *Hand-held Scanner*

Fig. 2.9: Types of Scanners

2.3. OUTPUT CONCEPTS

The output devices receive results and other information from the computer and provide it to the users. Output is the process of translating data in machine-readable form into a form understandable to humans or readable by other machines.

In today's information society, people require clear, legible and output. Output that can be understood by humans can be categorized as:

- *Hard copy*
- *Soft copy*

Hard copy is the output, such as paper, that can be read immediately or stored and read later. It is relatively stable and permanent form of output. *Soft copy* is usually a screen-displayed output. It is transient form of output and is lost when the computer is turned off. But if the data needed to create the soft copy have been saved on disk or tapes, the soft copy can be reproduced on the screen anytime.

2.4 OUTPUT DEVICES

Any peripheral that receives or displays output from a computer. An inkjet printer is a good example of an **output device** that can make a hard copy of anything on a computer. Below is a listing of all the different computer output devices found on a computer:

- Flat panel
- Monitor
- Printer
- Projector
- Sound card
- Speakers
- Video card

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An **output device** is any piece of computer hardware equipment used to communicate the results of data processing carried out by an information processing system (such as a computer) to the outside world.

Examples of output devices:

- Monitors
- Printers
- Plotters
- Speakers
- Headphones
- Voice Response Systems

Most of the computer output devices are common to home as well as office environments. At the same time, there are some devices, which are not as commonly available. Having said that, let's take a look at computer output devices list.

2.4.1 Monitors

A computer display is also called a display screen or video display terminal (VDT). A monitor is a screen used to display the output. Images are represented on monitors by individual dots called pixels. A pixel is the smallest unit on the screen that can be turned on and off or made different shades. The density of the dots determines the clarity of the images, the resolution.

Types of Computer Monitors

The computer **monitor** (also known as a **VDU** or **Visual Display Unit**) is the most common computer output device. For desktop computers, cathode ray monitors (**CRT**) are gradually being replaced by flat-screen monitors such as the Liquid Crystal Displays (**LCD**) and Thin Film Transistor (**TFT**) displays used with laptop computers because they use less power and take up less space.

2.4.2 Printers

A **printer** is a peripheral which produces a text and/or graphics of documents stored in electronic form, usually on physical print media such as paper or transparencies. Many printers are primarily used as local peripherals, and are attached by a printer cable or, in most new printers, a USB cable to a computer which serves as a document source. Some printers, commonly known as **network printers**, have built-in network interfaces, typically wireless and/or Ethernet based, and can serve as a hard copy device for any user on the network. Individual printers are often designed to support both local and network connected users at the same time. There are several printer technologies, the most common of which are:

- the daisy wheel printer
- the dot-matrix printer (also called *impact matrix printer*)
- the inkjet printer and the bubble jet printer
- the laser printer

Today, daisy wheel printers and matrix printers are hardly ever used.

2.4.2.1 Types of Printers

A printer is an output device that produces a *hard copy* of data. The resolution of printer output is expressed as DPI. Printers can be classified into different types in several ways.

First, the printers can be divided into three categories by the way they print.

- **Serial Printers:** Also called a character printer. Print a single character at a time. They are usually inexpensive and slow.
- **Line Printers:** Print a line at a time. They are expensive and very fast. Line printers use a band, a chain, etc.
- **Page Printers:** Also called a laser printer. Print a page at a time. They usually use a laser to produce page images. Quality is best. This is a little bit expensive, but the price of the personal laser printer is decreasing. The price range of the personal laser printer is around \$400, today.

Second, printers can be classified into two forms according to the use of a hammer.

- **Impact Printers:** Hammer hits ribbons, papers or print head. Dot-matrix and daisy-wheel printers are the example. Noisy.
- **Nonimpact Printers:** They do not have the hammer and do not hit. An example is an ink-jet and laser printer.

So, let's take a closer look at the various types of printers.

2.4.2.2 Character Printers

They are used to print only one character at a time. A typewriter is an example of a character printer. Some of character printers are described below.

2.4.2.3 Daisy-Wheel Printer

Daisy-Wheel Printer prints typewriter-like very high quality characters. However, they are slower and less reliable than dot-matrix printers. Microcomputer users seldom use this printer, because the better dot-matrix printers and inexpensive laser printers are available today. The speeds of daisy-wheel printers range from 30 to 60 characters per second (cps).

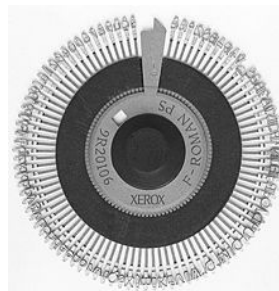


Figure 2.14: A daisy-wheel print wheel

2.4.2.4 Dot-Matrix Printer

The **dot-matrix printer** allows you to print documents on paper thanks to the "back and forth" motion of a carriage housing a print head.

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Dot-matrix printers are printers that write characters and form graphic images using one or two columns of tiny dots on a print head. The dot hammer moving serially across the paper strikes an inked-ribbon and creates images on paper.

- The print head travels from side to side across the paper and is made up of numerous pins which are pushed out to form the shape of each character.
- The pins hit an ink ribbon against the paper so the characters are printed out.
- The paper is usually continuous with holes down each side and perforations so the pages can be easily separated by tearing.

Because the pins make an impact against the paper the characters can be printed through several layers of self-carbonating paper to produce duplicate copies.



Figure 2.15: Dot Matrix Pins

An animation showing how head of a 21 pin dot-matrix printer moves across the paper, firing the pins that strike the ink against the paper.

Character Matrix Printer

Character matrix printers are a category of computer printers (typically impact printers) that place characters from a fixed character set anywhere onto a fixed grid of possible locations on the page. Examples of these are daisy wheel printers, golf ball printers, chain printers, and band printers. A character printer prints one character at a time.

2.2.4.5 Line Printers

Line printers, as the name implies, print an entire line of text at a time. The **line printer** is a form of high speed impact printer in which one line of type is printed at a time. They are mostly associated with the early days of computing, but the technology is still in use. Print speeds of 600 to 1200 lines-per-minute (approximately 10 to 20 pages per minute) were common.



Figure 2.16: IBM 1403 line printer

Designs

Four principal designs existed:

- Drum printers
- Chain (train) printers
- Band Printers

2.4.2.6 Page Printers

These are the very high speed non impact printers. They can produce documents at speeds of over 20,000 lines per minute. Electronics, xerography, lasers, and other technologies have made these high-volume systems possible. These techniques called electro-photographic techniques have developed from the paper copier technology. Page printers can produce pages of output at a rate equal to a photo copier.

2.4.2.7 Laser Printer

Laser printers are page printers that print one page at a time. It is a non-impact printer. A *laser printer* is a printer that uses the electro-photographic method used in a copy machine. A **laser printer** is a common type of computer printer that rapidly produces high quality text and graphics on plain paper.

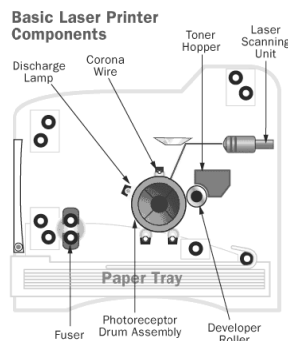


Figure 2.17: The basic components of a laser printer

The **laser printers** produce quality print-outs inexpensively at a high print speed. However, these printers are mostly used in professional and semi-professional settings because of their high cost.

2.4.2.8 Inkjet Printer

Ink-jet is a printer mechanism that sprays one or more color of ink at high speed onto the paper and produces high-quality printing. This printer also produces color printing as well as high-quality image. That is, ink-jet printers can be used for variety of color printing at a relatively low cost. Ink-jet printing has two methods: Continuous stream method and drop-on- demand method.

Inkjet printing, like laser printing, is a non-impact method.

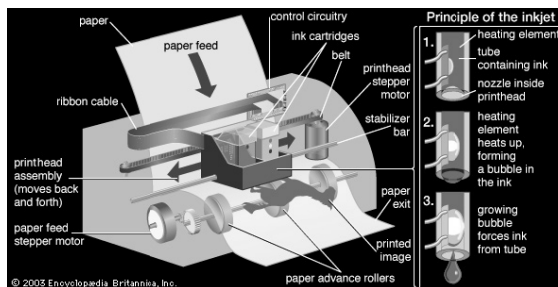


Figure 2.18: Ink Jet Printer

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Remarks**2.4.3 Plotter**

Plotters were the first type of printer that could print with color and render graphics and full-size engineering drawings. As a rule, plotters are much more expensive than printers. They are most frequently used for CAE (computer-aided engineering) applications, such as CAD (computer-aided design) and CAM (computer-aided manufacturing). Hewlett-Packard is the leading vendor of plotters worldwide.

Plotters are divided into four types:

1. Drum plotters
2. Flatbed plotters
3. Inkjet plotters
4. LED plotters

2.4.3.1 Drum Plotter

A drum plotter is pen plotter that wraps the paper around a drum with a pin feed attachment. The drum then rotates the paper as pens move across it and draw the image. It was the first output device used to print graphics and large engineering drawings.

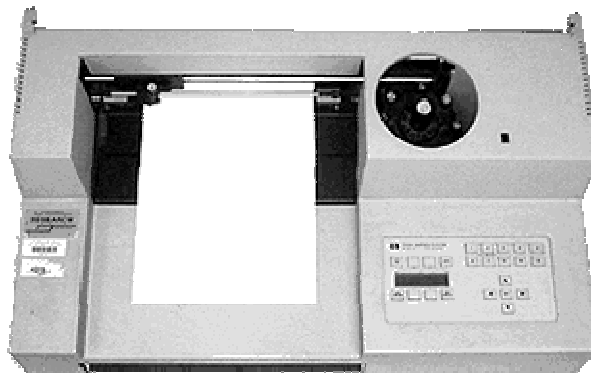


Figure 2.19: A drum plotter

2.4.3.2 Flatbed Plotter

A flat-bed plotter is a mechanical drafting device used with many CAD programs for designers. The paper remains stationary on a flat surface while a pen moves across it horizontally and vertically. A flatbed plotter is also known as Table Plotter.



Figure 2.20: Flatbed Plotter

2.4.3.3 The Inkjet Plotter

This is the third kind of Plotter which is called as the Inkjet plotter. The inkjet plotter creates an image by spraying small droplets of ink onto a piece of paper. A popular choice for advertising agencies and graphic designers, inkjet plotters are used generally for large outputs, such as banners and billboards and large signs often seen on roadsides.



Figure 2.21: Inkjet plotter

In Today's world, virtually all inkjets create color. Low-end inkjets make the most of the three ink colors (cyan, magenta and yellow), but finally create a complex black that is often mud-spattered. Four-color inkjets make use of the black ink created for pure black printing alone.

2.4.3.4 Led Plotter

LED plotters are also called as Electrostatic plotters. It works similar to Laser Printers except that it uses LED as the heat source instead of Laser.



Figure 2.22: LED plotter

2.4.4 Projector

Projectors are display devices that project a computer created image. The computer sends the image data to the video card which then sends the video image to the projector. They are typically used for presentations or for viewing videos.

An output device that can take the display of a computer screen and project a large version of it onto a flat surface. **Projectors** are often used in meetings and presentations so that everyone in the room can view the presentation. In the picture to the right, are a ViewSonic projector and an example of what a

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projector may look like. Projectors used with computers are small devices that are rarely much larger than a toaster and typically weigh a few pounds.

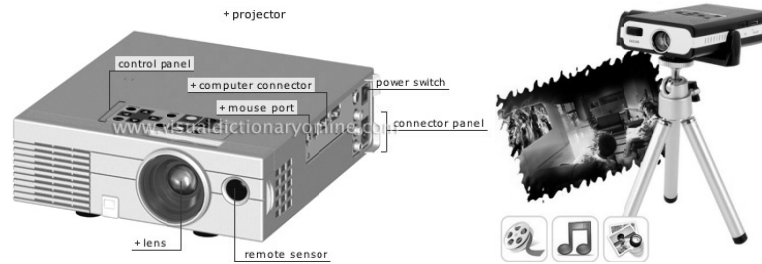


Figure 2.23: Projector

2.5 OTHER HARDWARE

Computer hardware is the collection of physical parts of a computer system. Apart from computer case, monitor, keyboard, mouse, printers, plotters, etc., it also includes all the parts inside the computer case, such as the hard disk drive, motherboard, video card, and many others. Computer hardware is what you can physically touch. Few such computer hardware devices and components are discussed as under.

Motherboard

The **motherboard** is the main circuit board of a computer. It contains the central processing unit (CPU), the Basic Input/Output System (BIOS), memory, mass storage interfaces, serial and parallel ports, expansion slots, and all the controllers for standard peripheral devices like the keyboard, disk drive and display screen.

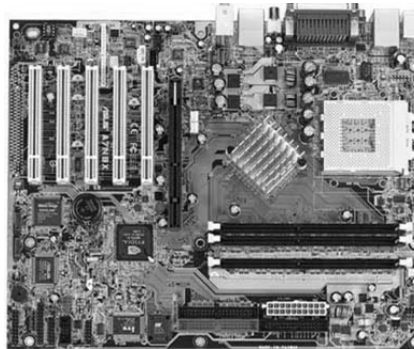


Figure 2.24: Motherboard

The **chipset** and other motherboard circuitry are the "smarts" of the motherboard. Their job is to direct traffic and control the flow of information inside the computer.

The **chipset** is a critical part of any computer, because it plays a big role in determining what sorts of features the computer can support.

CPU

The central processing unit (CPU), also called a **processor**, is located inside the **computer case** on the motherboard. It is sometimes called the brain of the computer, and its job is to carry out

commands. Whenever you press a key, click the mouse, or start an application, you're sending instructions to the CPU.

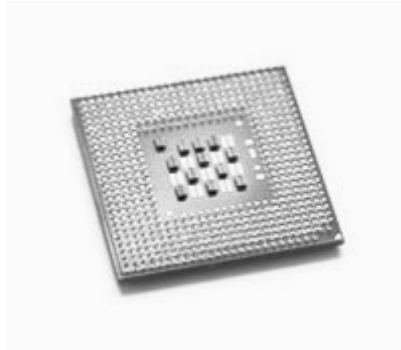


Fig. 2.25: Processor

The CPU is generally a **two-inch ceramic square** with a **silicon chip** located inside. The chip is usually about the size of a thumbnail. The CPU fits into the motherboard's **CPU socket**, which is covered by the **heat sink**, an object that absorbs heat from the CPU.

A processor's **speed** is measured in **megahertz (MHz)**, or millions of instructions per second; and **gigahertz (GHz)**, or billions of instructions per second. A faster processor can execute instructions more quickly. However, the actual speed of the computer depends on the speed of many different components—not just the processor. There are 2 main chip manufacturers, **Intel and AMD**.

RAM

Random Access Memory (RAM) is a critical performance component for computers. When a computer boots up, opens a program, and then opens a file, it loads these elements into RAM to do the work.

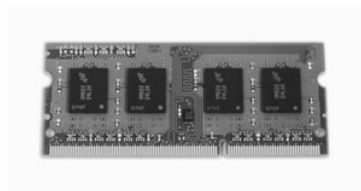


Figure 2.26: RAM

In general, you want to have as much RAM in your computer as you can afford. If you are running a 32 bit operating system, then each program can make use 2GB to 3 GB of RAM. If you have a 64bit OS, then each program can use as much RAM as you have available.

Video Card

A video card or Graphics Processing Unit (GPU) is the part of the computer that connects to the monitor. The GPU takes the video image and puts it in a form that can be displayed on the monitor. In most laptops, this is built into the system and cannot be replaced. In most desktop computers, the GPU fits into a slot on the motherboard, and can often be upgraded.

Remarks***Digital storage***

Every computer needs a storage device to store the operating system, programs and files. In the vast majority of cases, this is provided by one or more hard drives. Most computers have at least one internal hard drive, and they have the capability to connect to external drives.



Figure 2.27: Hard Disk

Most computers also have the ability to read and write optical disc like CD, DVD or Blu-ray. These are used for loading data and programs on and off the computer.

Digital storage is a critical part of any computer system, and using storage properly can be the difference between keeping your photos and losing them. For more information, take the course on digital storage and backups.

Power Supply Unit

The power supply unit in a computer **converts the power** from the wall outlet to the type of power needed by the computer. It sends power through cables to the motherboard and other components.



Figure 2.28: Power Supply Unit

Expansion cards

Most computers have **expansion slots** on the motherboard that allow you to add various types of **expansion cards**. These are sometimes called **PCI (peripheral component interconnect) cards**. You may never have to add any PCI cards because most motherboards have built-in video, sound, network, and other capabilities. However, if you want to boost the performance of your computer or update the capabilities of an older computer, you can always add one or more cards. Below are some of the most common types of expansion cards.

Sound Card

The **sound card**, also called an audio card, is responsible for **what you hear** in the speakers or headphones. Most motherboards have integrated sound, but you can upgrade to a dedicated sound card for higher-quality sound.

Network card

The **network card** allows your computer to communicate over a network and access the Internet. It can either connect with an **Ethernet** cable or through a **wireless** connection (often called **Wi-Fi**). Many motherboards have built-in network connections, and a network card can also be added to an expansion slot.

Bluetooth card

Bluetooth is a technology for wireless communication over short distances. It's often used in computers to communicate with wireless **keyboards**, **mice**, and **printers**. It's often built into the motherboard or included in a **wireless network card**. For computers that don't have Bluetooth, a USB adapter, called a **dongle**, can be purchased.



Figure 2.29: Dongle

SUMMARY OF THE LESSON

You learnt the following in this lesson:

- An **input device** is any hardware device that sends data to the computer, without any input devices, a computer would only be a display device and not allow users to interact with it, much like a TV.
- A keyboard is one of the today's most common and familiar input devices. A keyboard's primary function is to act as an **input device**.
- Mouse is a pointing device and it has been around us for more than 20 years
- A joystick is also a pointing device. It is used to move the cursor position on a CRT screen. Its function is similar to a mouse, except that with a mouse the cursor stops moving as soon as you stop moving the mouse.
- A touch screen is basically a display screen which can identify the occurrence and position of a touch inside the display region.
- Scanner is a kind of input device that can read text or printed paper and translates the information in a convenient form to be understood by the computer.
- **Hard copy** is the output, such as paper, that can be read immediately or stored and read later. It is relatively stable and permanent form of output. **Soft copy** is usually a screen-displayed output.
- Any peripheral that receives or displays output from a computer. An inkjet printer is a good example of an **output device** that can make a hard copy of anything on a computer.

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- The computer **monitor** (also known as a **VDU** or **Visual Display Unit**) is the most common computer output device.
- A **printer** is a peripheral which produces a text and/or graphics of documents stored in electronic form, usually on physical print media such as paper or transparencies.
- A printer is an output device that produces a *hard copy* of data. The resolution of printer output is expressed as DPI. Printers can be classified into different types in several ways.
- Plotters were the first type of printer that could print with color and render graphics and full-size engineering drawings.
- Computer hardware is the collection of physical parts of a computer system. Apart from computer case, monitor, keyboard, mouse, printers, plotters, etc., it also includes all the parts inside the computer case, such as the hard disk drive, motherboard, video card, and many others.

SELF ASSESSMENT QUESTIONS AND EXERCISES

1. What are input devices?
2. What do you mean by keyboard?
3. Explain the concept of mouse?
4. Explain the speech recognition system in detail?
5. What do you mean by digital camera?
6. Explain the working of scanners?
7. What do you mean by output devices?
8. What are printers? Explain the various types of printers in detail?
9. Explain the various types of plotters?
10. What do you mean by monitor?
11. Explain the various types of monitors?
12. What do you mean by projector?
13. State the necessities of Input and Output devices.
14. What are the reasons for the visual display unit to be more popular than punched card reader?
15. What is a Keyboard? How does a simple keyboard differ from an ergonomically designed keyboard?