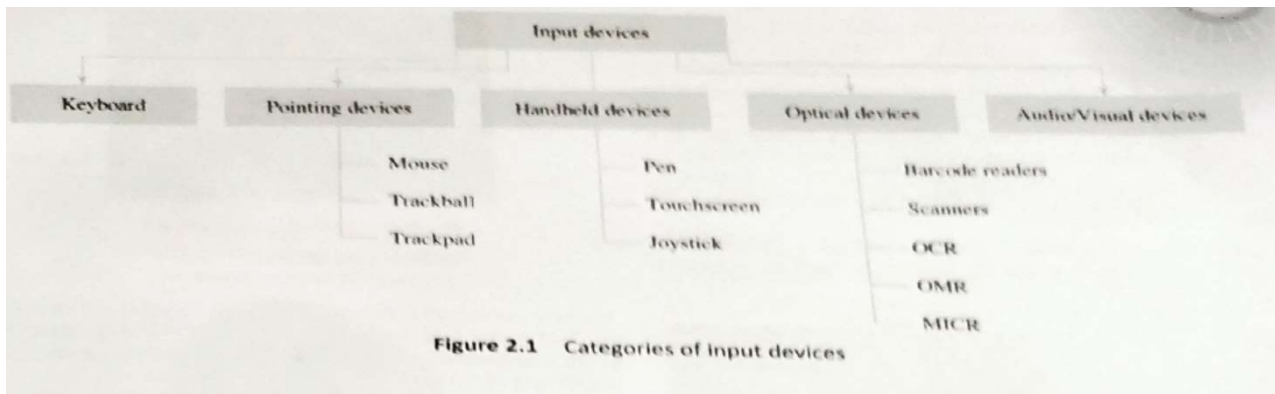


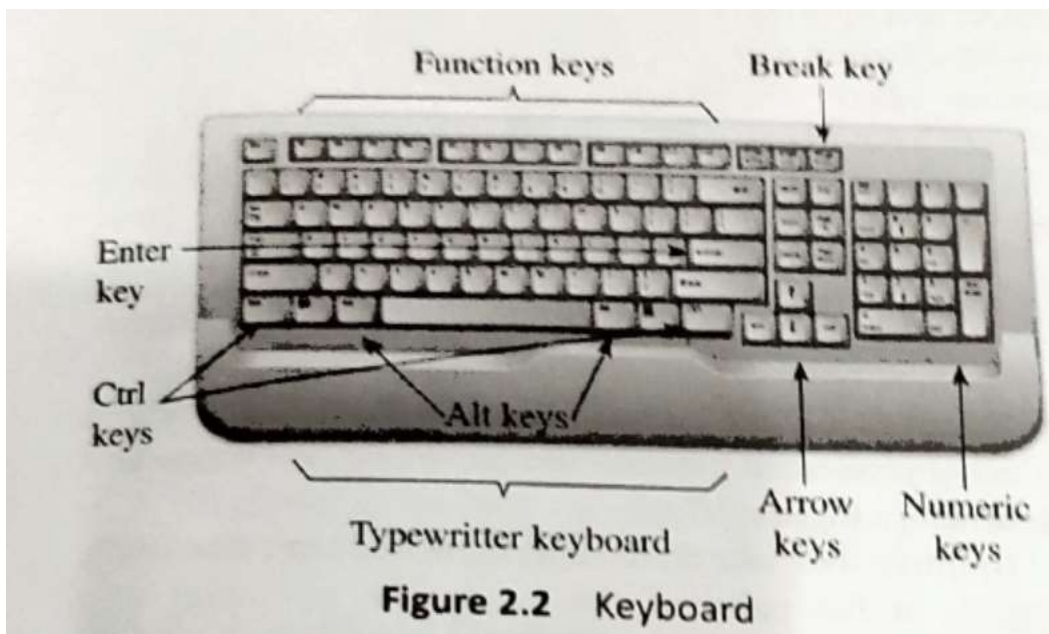
Chapter 2: Input and Output devices

2.1 INPUT DEVICES An input device is used to feed data and instructions into a computer.



2.1.1 Keyboard The keyboard is the main input device for computers.

Computer keyboards look very similar to the keyboards of typewriters, with some additional keys.



Using a keyboard, the user can type a document, use keystroke shortcuts, access menus, play games, and perform numerous other tasks. Most keyboards have between 80 and 110 keys, which include the following:

Typing keys These include the letters of the alphabet. The layout of the keyboard is known as QWERTY for its first six letters. The QWERTY pattern has been a standard right from the time computer keyboards were introduced.

Numeric keys These include a set of keys, arranged in the same configuration found on calculators to speed up data entry of numbers. When the Num Lock key is set to ON, the user can type numbers, dot, or input the symbols/, *, –, and +. When the Num Lock key is set to OFF, the numeric keys can be used to move the cursor on the screen.

Function keys These are used by applications and operating systems to input specific commands. They are

often placed on the top of the keyboard in a single row. Function keys can be programmed so that their functionality varies from one program to another.

Control keys These are used to handle control of the cursor and the screen. Four arrow keys are arranged in an inverted T -type fashion between the typing and the numeric keys, and are used to move the cursor on the screen in small increments. In addition to the arrow keys, there are other cursor keys (or navigational keys), such as:

- Home and End to move the cursor to the beginning and end of the current line, respectively
- Page Up and Page Down to move the cursor up and down by one screen at a time, respectively.
- Insert to enter a character between two existing characters
- Delete to delete a character at the cursor position.

Other common control keys on the keyboard include Control (Ctrl), Alternate (Alt), Escape (Esc), Print Screen, Pause, the Windows or Start key (Microsoft Windows logo), and a shortcut key. The shortcut key is used to access the options available by pressing the right mouse button. The Esc key cancels the selected option, and the Pause key suspends a command/process in progress. Finally, the Print Screen key captures everything on the screen as an image. The image can be pasted into any document.

Note Keys such as Shift, Ctrl, and Alt are called modifier keys because they are used to modify the normal function of a key. For example, Shift + character (lowercase) makes the computer display the character in upper case.

Inside the Keyboard

A keyboard is like a miniature computer that has its own processor and circuitry to carry information to and from that processor. The circuitry has a key matrix, which is a grid of circuits underneath the keys. Each circuit is broken at a point below each key. When a key is pressed, it corresponds to pressing a switch, thereby When the processor finds a closed circuit, it compares the location of that circuit on the key matrix to the character map in its read-only memory (ROM). A character map is a lookup table that tells the processor what each keystroke or a combination of keystrokes represents. For example, the character map tells the processor that pressing the key 'c' corresponds to a small letter 'c' but the keys 'Shift' and 'c' pressed together is a 'C'.

Advantage The keyboard is easy to use and inexpensive.

Disadvantages

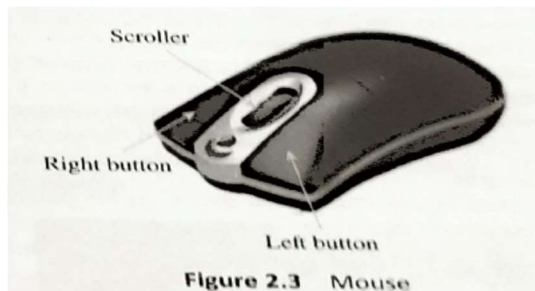
- The keyboard cannot be used to draw figures.
- The process of moving the cursor to another position is very slow. Mouse and other pointing devices are more apt for this purpose.

2.1.2 Pointing Devices

A pointing input device enables the users to easily control the movement of the pointer to select items on a

display screen, to select commands from commands menu, to draw graphics, etc. Some examples of pointing devices include mouse, trackball, light pen, joystick, and touchpad.

Mouse The mouse is an input device that was invented by Douglas Engelbart in 1963. It is the key input device used in a graphical user interface (GUI). It can be used to handle the pointer easily on the screen to perform various functions such as opening a program or file. With the mouse, the users no longer need to memorize commands, which was earlier a necessity when working with text-based command line environments like MS-DOS.



The mouse has two buttons and a scroll wheel. It can be held in the hand and easily moved, without lifting, along a hard flat surface to move the cursor to the desired location—up, down, left, or right. Once the mouse is placed at the appropriate position, the user may perform the following operations:

Point Placing the pointer over the word or the object on the screen by moving the mouse on the desk is termed as pointing.

Click Pressing either the left or the right button of the mouse is known as clicking. Clicking a mouse button initiates some action; for example, when we click the right button by pointing the mouse on a word, a menu pops up on the screen. When we move the pointer over the icon of an application, say Internet Explorer, and double-click on it, then it opens that application.

Drag Dragging means pointing to a desired location while pressing the left button.

Scroll The scroll wheel, which is placed in between the left and right buttons of the mouse, is used to vertically scroll through long documents.

Some of the popular mouse types are as follows:

Mechanical mouse This type of mouse has a rubber or metal ball at its bottom and an electronic circuit containing sensors. When the mouse is moved over a flat surface, the sensors detect the direction of movement of the ball. The electronic circuit translates the movement into signals and feeds it as input to the computer.

Optical mouse The optical mouse is more advanced than the mechanical mouse. It contains a ball inside. The movement of the mouse is detected using laser technology, by using optical sensors.

Cordless mouse A cordless or wireless mouse is not connected to the computer. The movement of the mouse is detected using radio waves or infrared light waves.

Advantages

- The mouse is easy to use and can be used to quickly place the cursor anywhere on the screen.
- It also helps to quickly and easily draw figures.
- It is inexpensive.
- Its point-and-click capabilities make it unnecessary to remember and type in commands.

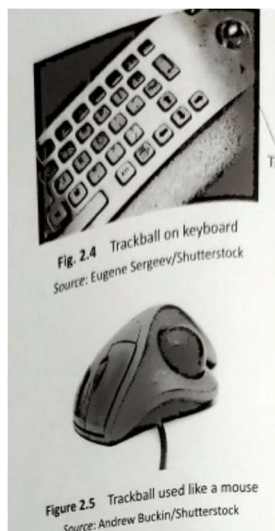
Disadvantages

- The mouse needs extra desk space to be placed and moved easily.
- The ball in the mechanical mouse must be cleaned to remove dust from it.

Trackball

A trackball is a pointing device that is used to control the position of the cursor on the screen. It is usually used in notebook computers, where it is placed on the keyboard. The trackball is nothing but an upside-down mouse where the ball rotates in place within a socket. The user rolls the ball to position the cursor at an appropriate position on the screen and then clicks one of the buttons (identical to mouse buttons) near the trackball, either to select objects or to position the cursor for text entry.

To move the pointer, the ball is rotated with the thumb, fingers, or the palm of the hand. The advantage of a trackball over a mouse is that the former is stationary, and so it does not require much space to use. Moreover, individual trackballs can be placed on any type of surface, including the user's lap. These advantages make trackballs very popular pointing devices for portable computers and mobile phones. The working of a trackball is identical to that of mouse.



Advantages

- The trackball provides better resolution.
- It occupies less space.
- It is easier to use as compared to a mouse as its use involves less hand and arm movements.

Disadvantage The trackball chamber is often covered with dust, so it must be cleaned regularly.

Touchpad A touchpad (or trackpad) is a small, flat, rectangular stationary pointing device with a sensitive surface of 1.5–2 square inches. The user has to slide his or her fingertips across the surface of the pad to point to a specific object on the screen.



Figure 2.6 Touchpad

Advantages

- Touchpads occupy less space.
- They are easier to use as compared to a mouse as their use involves less hand and arm movements.
- A touchpad is in-built in the keyboard, and hence negates the need to carry an extra device.

2.1.3 Handheld Devices

A handheld device is a pocket-sized computing device with a display screen and touch input and/or a miniature keyboard. Some common examples of handheld devices include smartphones, PDAs, handheld game consoles, and portable media players (e.g., iPods). In this section, we will read about joystick stylus (pen) and touchscreens, which are the means to input data to handheld devices.

Joystick A joystick is a cursor control device widely used in computer games and computer aided design (CAD)/ computer - aided manufacturing (CAM) applications. It consists of a handheld lever that pivots on one end and transmits its coordinates to a computer. A joystick has one or more push buttons, called switches, whose position can also be read by the computer. The lever of a joystick moves in all directions to control the movement of the pointer on the computer screen. A joystick is similar to a mouse, but with the mouse, the cursor stops moving as soon as you stop moving the mouse. However, in case of a joystick, the pointer continues moving in the direction to which the joystick is pointing. To stop the pointer, the user must return the joystick to its upright position.

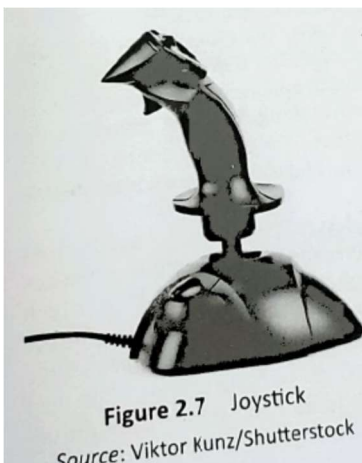


Figure 2.7 Joystick

Source: Viktor Kunz/Shutterstock

Stylus A stylus is a pen-shaped input device used to enter information or write on the touchscreen of a

handheld device. It is a small stick that can also be used to draw lines on a surface as input into a device, choose an option from a menu, move the cursor to another location on the screen, take notes, and create short messages. The stylus usually slides into a slot built into the device for that purpose.

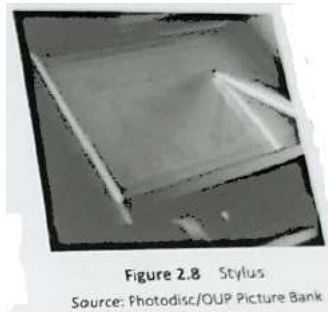


Figure 2.8 Stylus

Source: Photodisc/OUP Picture Bank

Touchscreen A touchscreen is a display screen that can identify the occurrence and position of a touch inside the display region. The user can touch the screen either by using a finger or a stylus. The touchscreen facilitates the users to interact with what is displayed on the screen in a straightforward manner, rather than in an indirect way by using a mouse or a touchpad. Touchscreens make using another input device redundant, since the user can interact with the screen by directly touching it. Such touchscreen displays are available on computers, laptops, PDAs, and mobile phones. Touchscreen monitors are an easy way of entering information into the computer (or mobile phone, etc). Touchscreen monitors have become more and more commonplace as their price has steadily dropped over the past decade. These days, touchscreen monitors are widely used in different applications including point-of-sale (POS) cash registers, PDAs, automated teller machines (ATMs), car navigation screens, mobile phones, gaming consoles, and any other type of appliance that requires the user to input and receive information instantly.

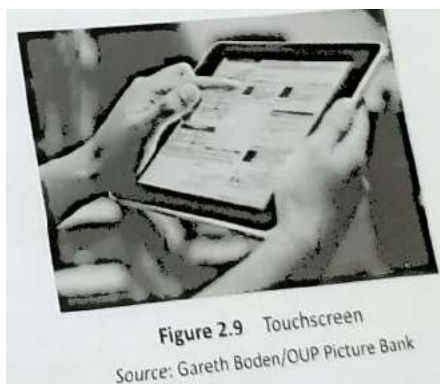


Figure 2.9 Touchscreen

Source: Gareth Boden/OUP Picture Bank

2.1.4 Optical Devices

Optical devices, also known as data-scanning devices, use light as a source of input for detecting or recognizing different objects such as characters, marks, codes, and images.

Barcode Reader A barcode reader (also price scanner or POS scanner) is a handheld input device that is used to capture and read information stored in a barcode. It consists of a scanner, a decoder, and a cable used to connect the reader to a computer. The function of the barcode reader is to capture and translate the barcode into numerals and/or letters. It is connected to a computer for further processing of the captured

information. This connection is achieved through a serial port, keyboard port, or an interface device called a wedge.

These days, barcode readers are widely used in following areas:

- Generate bills in supermarkets and retail stores
- Take stock of inventory in retail stores
- Check out books from a library
- Track manufacturing and shipping movement
- Keep track of employee login
- Identify hospital patients
- Tabulate the results of direct mail marketing returns
- Tag honeybees used in research

Advantages

- Barcode readers are inexpensive.
- They are portable.
- They are handy and easy to use.

Disadvantages

- Barcode readers must be handled with care. If they develop a scratch, the user may not be able to read the code.
- They can interpret information using a limited series of thin and wide bars. To interpret other unique identifiers, the bar display area must be widened.

Image Scanner

A scanner is a device that captures images, printed text, and handwriting, from different sources such as photographic prints, posters, and magazines and converts them into digital images for editing and display on computers.



Figure 2.10 Flatbed Image scanner
Source: Mile Atanasov/Shutterstock

Advantages

- Any printed or handwritten document can be scanned and stored in a computer for further processing.
- The scanned and stored document will never deteriorate in quality with time. The document can be

displayed and printed whenever required.

- There is no fear of loss of documents. The user can scan important documents and store them permanently in the computer.

Disadvantages

- Scanners are usually costlier than other input devices.
- The documents that are scanned and stored as images have a higher size as compared to other equivalent text files.
- Text documents are scanned and stored as images. Therefore, they occupy more space and are also un-editable because computers cannot interpret individual characters and numbers in the image.

Optical Character Recognition (OCR) Device

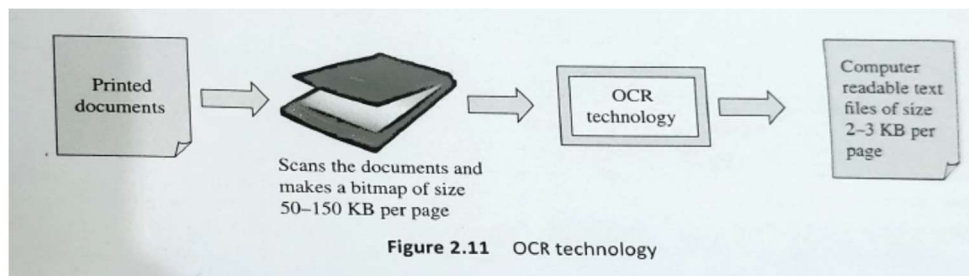
Optical character recognition is the process of converting printed materials into text or word processing files that can be easily edited and stored.

The steps involved in OCR include:

- Scanning the text character by character
- Analysing the scanned image to translate the character images into character codes (e.g., ASCII).

These days, OCR is widely used in the following areas:

- Digitize and preserve documents in libraries
- Process checks and credit card slips
- Sort letters for speeding up mail delivery



Advantages

- Printed documents can be converted into text files.
- Advanced OCR can recognize handwritten text and convert it into computer-readable text files.

Disadvantages

- OCR cannot recognize all types of fonts.
- Documents that are poorly typed or have strikeover cannot be recognized.
- Very old documents when passed through OCR may not convert into an exact copy of the text file. This is because some characters may not have been recognized properly. In such cases, the user has to manually edit the file.

Optical Mark Recognition (OMR) Device

Optical mark recognition is the process of electronically extracting data from marked fields, such as checkboxes and fill-in fields, on printed forms.

The optical mark reader, is fed with an OMR sheet that has pen or pencil marks in pre-defined positions to indicate each selected response (e.g., answers for multiple-choice questions in an entrance examination). The OMR sheet is scanned by the reader to detect the presence of a mark by measuring the reflected light levels. The dark or the marked areas reflect less light than the unmarked ones. The OM reader interprets this pattern of marks and spaces, and stores the interpreted data in a computer for storage, analysis, and reporting. The error rate for OMR technology is less than 1%. For this reason, OMR is widely used for applications in which large numbers of hand-filled forms have to be quickly processed with great accuracy, such as surveys, reply cards, questionnaires, ballots, or sheets for multiple-choice questions.

Advantage

Optical mark readers work at very high speeds. They can read up to 9000 forms per hour.

Disadvantages

- It is difficult to gather large amounts of information using an OMR.
- Some data may be missing in the scanned document.
- It is a sensitive device that rejects the OMR sheet if it is folded, torn, or crushed.

Magnetic Ink Character Reader

Magnetic ink character reader (MICR) is used to verify the legitimacy of paper documents, especially bank checks. It consists of magnetic ink printed characters that can be recognized by high-speed magnetic recognition devices. The printed characters provide important information (such as cheque number, bank routing number, account number, and, in some cases, the amount on the cheque) for processing to the receiving party.

Audiovisual Input Devices In addition to having a keyboard and a mouse, audio–video devices have become a necessity today.

Audio Devices Audio devices are used to either capture or create sound. They enable computers to accept music, speech, or sound effects for recording and/or editing. Microphones and CD players are examples of two widely used audio input devices. A microphone feeds audio input to the computer. However, the audio input must be converted into digital data before being stored in the computer.

Video Input Devices Video input devices are used to capture video from the outside world into the computer. Here, the term video means moving picture along with sound (as in television). Digital camera and web camera are popular examples of video input devices. A digital camera is a handheld and easily portable device used to capture images or videos. The digital camera digitizes image or video (converts them into 1s and 0s) and stores them on a memory card. The data can then be transferred to the computer using a cable that connects the computer to the digital camera. Once the images or videos are transferred to

the computer, they can be easily edited, printed, or transmitted (e.g., through e-mails).

Advantages

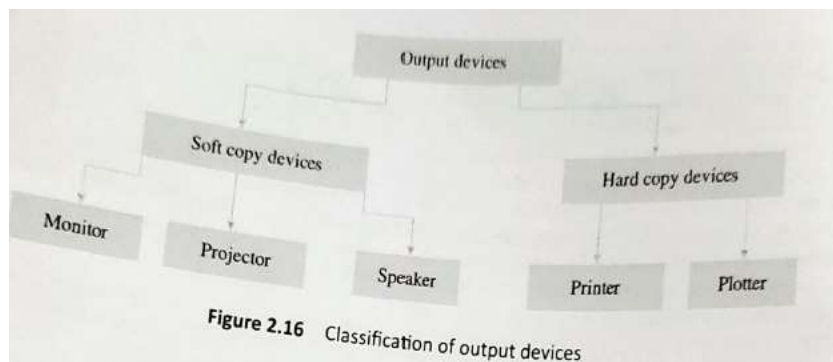
- Audio devices can be used by people who are visually impaired.
- Audio input devices are best used in situations where users want to avoid input through keyboard or mouse.
- Video input devices are very useful for applications such as videoconferencing.
- They can be used to record memorable moments in one's life.
- They can also be used for security purposes.

Disadvantages

- Audio input devices are not effective in noisy places.
- With audio input devices, it is difficult to clearly distinguish between two similar sounding words such as 'sea' and 'see'.
- Videos and images captured using video input devices have very big file sizes, and they must be compressed before being stored on the computer.

2.2 OUTPUT DEVICES

Any device that outputs/gives information from a computer can be called an output device. Basically, output devices are electromechanical devices that accept digital data (in the form of 0s and 1s) from the computer and convert them into human-understandable language.



2.2.1 Soft Copy Devices Soft copy output devices are those that produce an electronic version of an output—for example, a file that is stored on a hard disk, CD, or pen drive—and is displayed on the computer screen (monitor).

Features of a soft copy output include the following:

- The output can be viewed only when the computer is on.
- The user can easily edit soft copy output.
- Soft copy cannot be used by people who do not have a computer.
- Searching for data in a soft copy is easy and fast.
- Electronic distribution of material as soft copy is cheaper. It can be done easily and quickly.

Monitors The monitor is a soft copy output device used to display video and graphics information generated by the computer through the video card. Computer monitors are similar to television screens but they display information at a much higher quality. The monitor is connected to either the VGA or the digital video interface (DVI) port on the video card (on the motherboard or separately purchased). Monitors come in three variants—cathode ray tube (CRT), liquid crystal display (LCD), and plasma.

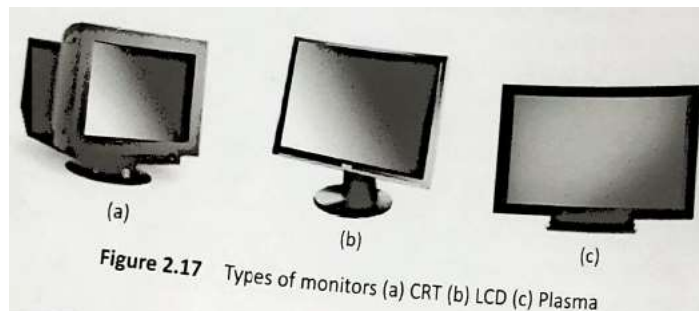


Figure 2.17 Types of monitors (a) CRT (b) LCD (c) Plasma

CRT monitor CRT monitors work by firing charged electrons at a phosphorus film. When electrons hit the phosphor-coated screen, they glow, thereby enabling the user to see the output. In a CRT, the cathode (negative terminal) is a heated filament that is placed in a vacuum created inside a glass tube. The ray is a stream of electrons that come out from a heated cathode into the vacuum. While electrons are negative, the anode, on the other hand, is positive, so it attracts the electrons coming out of the cathode. That is, the focusing anode focuses the stream of electrons to form a tight beam that is then accelerated by an accelerating anode. This tight, high-speed beam of electrons flies through the vacuum in the tube and hits the flat screen at the other end of the tube. This screen is coated with phosphor, which glows when struck by the beam, thereby displaying a picture, which the user sees on the monitor.

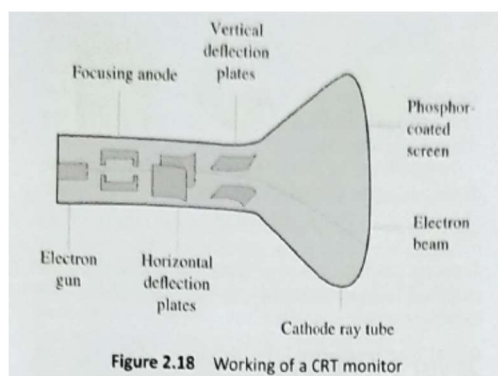


Figure 2.18 Working of a CRT monitor

Colour CRT monitors contain three electron guns (one each for red, blue, and green). Each pixel or dot on the screen has three phosphors (red, blue, and green). When the beam from these guns is focused on the phosphors, they light up. By varying the intensities of the beam, the user can obtain different colours.

Advantages

- CRT monitors provide images of good quality (bright as well as clear).
- CRT monitors are cheapest when compared to LCD and plasma monitors.
- The images are clear even when you try to view it from an angle.

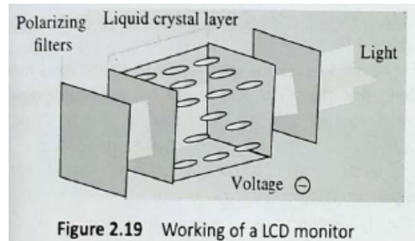
Disadvantages

- CRT monitors occupy a large space on the desk.
- They are bigger in size and weight and therefore difficult to move from one place to another when compared with other types of monitors.
- Power consumption is higher than the other monitors.

LCD Monitor

An LCD monitor is a thin, flat, electronic visual display that uses the light modulating properties of liquid crystals, which do not emit light directly. LCD screens are used in a wide range of applications ranging from computer monitors, televisions, instrument panels, aircraft cockpit displays, signage, etc., to consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones. Most LCD displays use active matrix technology in which a thin film transistor (TFT) arranges tiny transistors and capacitors in a matrix on the glass of the display. To refer to a particular pixel, the proper row is turned on, and then a charge is sent through the correct column. Since all the other rows are switched off, only the capacitor at the designated pixel receives a charge.

Passive matrix technology is the other type of LCD, which uses a grid of conductive metal to charge each pixel. Although these LCDs are cheaper, they are hardly used today because of slow response time and imprecise voltage control compared to active matrix technology.



Advantages

- LCD monitors are very compact and lightweight.
- They consume less power.
- They do not suffer from geometric distortion.
- There is little or no flicker of images (depending on the backlight technology used).
- They are more reliable than CRTs.
- They can be made in almost any size or shape.
- They cause less eye fatigue.

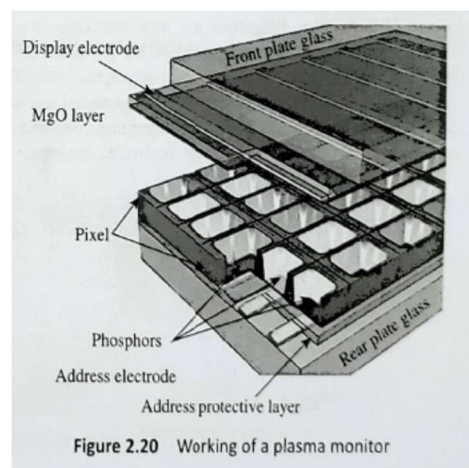
Disadvantages

- They are more expensive than CRTs.
- Images are not very clear when tried to view from an angle.

Plasma monitor Plasma monitors are thin and flat monitors widely used in televisions and computers. The

plasma display contains two glass plates that have hundreds of thousands of tiny cells filled with xenon and neon gases. The address electrode and the transparent display electrode are sandwiched between the glass plates. The display electrode is covered by a magnesium oxide protective layer and is arranged in horizontal rows along the screen, while the address electrodes are arranged in vertical columns, thereby forming a grid-like structure.

To ionize the gas in a particular cell, the electrodes that intersect at that cell are charged at least thousands of times within a small fraction of a second (charging each cell in turn).



Advantages

- The technology used in plasma monitors allows producing a very wide screen using extremely thin materials.
- Very bright images are formed which look good from almost every angle.
- These monitors are not heavy and are thus easily portable.

Disadvantages

- These monitors are very expensive.
- They have a high power consumption.
- Since the images are phosphor-based, at times, they may suffer from flicker.

Projectors

A projector is a device that takes an image from a video source and projects it onto a screen or another surface. These days, projectors are used for a wide range of applications, varying from home theater systems for projecting movies and television programs onto a screen much larger than even the biggest available television, to organizations for projecting information and presentations onto screens large enough for rooms filled with many people. Projectors also allow users to change/adjust some features of the image such as brightness, sharpness, and colour settings, similar to the features available in a standard television. Projectors are now available in a variety of different shapes and sizes, and are produced by many different companies.

The projector works by receiving a video signal from some external device such as a DVD player or a computer and projects that signal onto a screen. To display the image on a big screen, the projector first displays that image (represented in the video signal) onto a small screen inside the projector itself, which is then projected onto the final screen using bright light and a lens. The lens is shaped in such a way that it takes the small image and turns it into a dramatically larger one.

Projectors can be broadly classified into two categories depending on the technology they use.

LCD projector LCD projectors make use of their own light to display the image on the screen/wall. These projectors are based on LCD technology. To use these projectors, the room must be first darkened, else the image formed will be blurred.

Digital light processing (DLP) projector DLP projectors use a number of mirrors to reflect the light. When using the DLP projector, the room may or may not be darkened because it displays a clear image in both situations.

Speakers Today, all business and home users demand audio capabilities from their computers. For this purpose, speakers were developed in different sizes and shapes, and with different powers and sound quality.

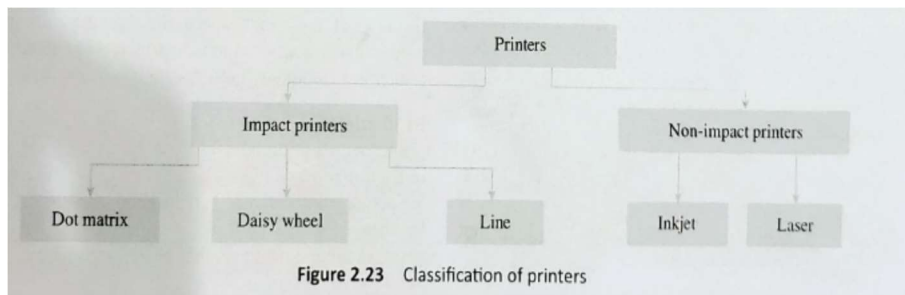
Headphones are small devices that fit in or on the ear, and give about the same quality and power of the sound, as the speakers, only to the listener. Most of today's headphones feature some noise-cancelling technologies, so that the listener may listen to only the sound from the speakers and not anything else from the surrounding environment. Users often use headphones to chat with people over the Internet. With headphones, they are assured that the conversation is heard only by them. However, in addition to the headphones, they are also required to use a separate microphone to talk to the other person. Hence, another device called the headset was developed to allow users to talk and listen at the same time, using the same device. Headsets are widely used in call centers and other telephone-intensive jobs, and for personal use on the computer to facilitate comfortable simultaneous conversation and typing.

Although every computer has a built-in speaker, an external speaker disables this lower-fidelity built-in speaker. Speakers available in the market have a wide range of quality and prices. The normal computer speakers are small, plastic, and have mediocre sound quality. Other speakers are available that have equalization features such as bass and treble controls. Users can also use a lead to connect their computer's sound output to an existing stereo system to give much better results than the small, low-cost computer speakers.

2.2.2 Hard Copy Devices Hard copy output devices are those that produce a physical form of output. For example, the content of a file printed on paper is a form of hard copy output. The features of hard copy output include:

- A computer is not needed to see the output.

- Editing and incorporating the edits in the hard copy is difficult.
- Hard copy output can be easily distributed to people who do not have a computer.
- Searching for data in a hard copy is a tiring and difficult job.
- Distribution of hard copy is not only costly but slower as well.



Printers A printer is a device that takes the text and graphics information obtained from a computer and prints it on a paper. Printers are available in the market in various sizes, speeds, sophistication, and costs. Usually, more expensive printers are used for higher-resolution colour printing. The qualities of printers that are of interest to users include:

Colour Colour printouts are needed for presentations, maps, and other pages where colour is part of the information. Colour printers can also be set to print only in monochrome. These printers are more expensive, so if the users do not have a specific need for colour and usually take a lot of printouts, they will find a black-and-white printer cheaper to operate.

Resolution The resolution of a printer means the sharpness of text and images rendered on paper. It is usually expressed in dots per inch (dpi). Even the least expensive printer provides sufficient resolution for most purposes at 600 dpi.

Speed Speed means number of pages that are printed in one minute. The speed of a printer is an important factor for users who have a large number of pages to print. While high-speed printers are quite expensive, the inexpensive printers, on the other hand, can print only about 3–6 sheets per minute. Colour printing is even slower.

Memory Most printers have a small amount of memory (for example, 1 MB), which can be expanded by the user. Having more memory enhances the speed of printing.

Printers can be broadly classified into two groups: impact and non-impact printers.

Impact Printer These printers print characters by striking an inked ribbon against the paper. Examples of impact printers include dot matrix printers, daisy wheel printers, and most types of line printers.

Advantages

- These printers enable the user to produce carbon copies.
- They are cheap.

Disadvantages

- Impact printers are slow.
- They offer poor print quality, especially in the case of graphics.
- They can be extremely noisy.
- They can print only using the standard font.

Non-impact printer Non-impact printers are much quieter than impact printers, as their printing heads do not strike the paper. They offer better print quality, faster printing, and the ability to create prints that contain sophisticated graphics. Non-impact printers use either solid or liquid cartridge-based ink, which is either sprayed, dripped, or electrostatically drawn onto the page. The main types of non-impact printers are inkjet, laser, and thermal printers.

Advantages

- Non-impact printers produce prints of good quality, and hence render sophisticated graphics.
- They are noiseless.
- They are fast.
- They can print text in different fonts.

Disadvantages

- These printers are expensive.
- The ink cartridges used by them are also costly.

Dot matrix printer

A dot matrix printer prints characters and images of all types as a pattern of dots (hence the name). This printer has a print head (or hammer) that consists of pins representing the character or image. The print head runs back and forth, or in an up-and-down motion on the page and prints by striking an ink-soaked cloth ribbon against the paper, much like the print mechanism of a typewriter.

The speed of dot matrix printers varies in the range of 50–500 cps (characters per second).

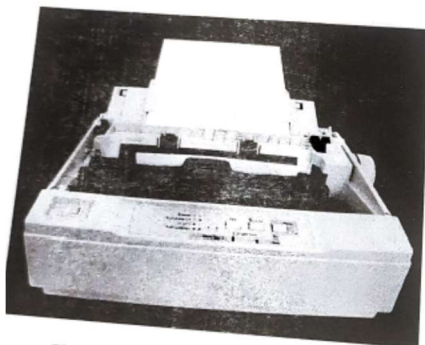


Figure 2.24 Dot matrix printer
Source: burnel1/Shutterstock

Advantages

- The dot matrix printer can produce carbon copies.
- It offers the lowest printing cost per page.

- It is widely used for bulk printing where the quality of the print is not of much importance.
- It is inexpensive.
- When the ink is about to be exhausted, the printout gradually fades rather than suddenly stopping partway through a job.
- It can use continuous paper rather than individual sheets, making them useful for data logging.

Disadvantages

- This type of printer creates a lot of noise when the pins strike the ribbon against the paper.
- It can only print lower resolution graphics, with limited quality.
- It is very slow.
- It has poor print quality.

Daisy wheel printer Daisy wheel printers use an impact printing technology to generate high quality output comparable to typewriters, and are three times faster. However, today, daisy wheel technology is found only in some electronic typewriters. The printhead of a daisy wheel printer is a circular wheel, about 3 inches in diameter with arms or spokes. The shape of the printer wheel resembles the petals of a daisy flower, and hence its name. The characters are embossed at the outer ends of the arms.

To print a character, the wheel is rotated in such a way that the character to be printed is positioned just in front of the printer ribbon. The spoke containing the required character is then hit by a hammer, thereby striking the ribbon to leave an impression on the paper placed behind the ribbon. The movement of all these parts is controlled by a microprocessor in the printer.

The key benefit of using a daisy wheel printer is that the print quality is high, as the exact shape of the character hits the ribbon to leave an impression on the paper.

Line printer A line printer is a high-speed impact printer in which one typed line is printed at a time. The speed of a line printer usually varies from 600 to 1200 lines per minute, or approximately 10–20 pages per minute. Because of their high speed, line printers are widely used in data centers and in industrial environments. Band printer is a commonly used variant of line printers.

Band printer A band printer (loop printer), is an impact printer with a printing mechanism that uses a metal loop or band to produce typed characters. The set of characters are permanently embossed on the band, and this set cannot be changed unless the band is replaced. The band itself revolves around hammers that push the paper against the ribbon, allowing the desired character to be produced on the paper.

The main advantage of using a band printer is its high speed. This type of printer can print 2000 lines per minute, and is, therefore, perfect for high volume printing in businesses, schools, and other organizations. Band printers are normally attached to mainframes and used for industrial printing.

Inkjet printers Inkjet printers, came in the market in the 1980s, but it was only in the 1990s that their prices reduced enough to bring the technology to the high street. Inkjet printers have made rapid

technological advances in recent years. The colour inkjet printers have succeeded in making colour printing an affordable option even for home users. The printhead of inkjet printers has several tiny nozzles, also called jets. As the paper moves past the printhead, the nozzles spray ink onto it, forming characters and images. If we observe a printout that has just come out from an inkjet printer, we will see that the dots are extremely small (usually between 50 and 60 microns in diameter) and are positioned very precisely, with resolutions of up to 1440×720 dpi. To create a coloured image, the dots can have different colours combined together. An inkjet printer can produce from 100 to several hundred pages (depending on the nature of the hard copy), before the ink cartridges must be replaced. There is usually one black ink cartridge and one colour cartridge containing ink in primary pigments (cyan, magenta, and yellow).

While inkjet printers are cheaper than laser printers, they are more expensive to maintain. The cartridges of inkjet printers have to be changed more frequently, and the special coated paper required to produce high quality output is very expensive. Hence, the cost per page of inkjet printers becomes ten times more than laser printers. Therefore, inkjet printers are not well suited for high volume print jobs.



Figure 2.25 Inkjet printer

Laser printer A laser printer is a non-impact printer that works at very high speeds and produces high-quality text and graphics. It uses the technology used in photocopier machines.

When a document is sent to the printer, the following steps take place:

- A laser beam ‘draws’ the document on a drum (which is coated with a photo-conductive material) using electrical charges.
- After the drum is charged, it is rolled in a toner (a dry powder type of ink).
- The toner sticks to the charged image on the drum.
- The toner is transferred onto a piece of paper and fused to the paper with heat and pressure.
- After the document is printed, the electrical charge is removed from the drum and the excess toner is collected.

While colour laser printers are also available in the market, users mostly prefer monochrome printers, because the former is up to ten times more expensive than the latter.



Figure 2.26 Laser printer

Plotters A plotter is a printing device that is usually used to print vector graphics with high print quality. They are widely used to draw maps, in scientific applications, and computer-aided engineering (CAE). Architects use plotters to draw blueprints of the structures they are working on. A plotter is basically a printer that interprets commands from a computer to make line drawings on paper with one or more automated pens. Since plotters are much more expensive than printers, they are used only for specialized applications. There are two different types of plotters, drum and flatbed.



Figure 2.27 Plotter

Drum plotter A drum plotter is used to draw graphics on paper that is wrapped around a drum. This type of plotter is usually used with mainframe and minicomputer systems. The drum plotter works by rotating the drum back and forth to produce vertical motion. The pen, which is mounted on a carriage, is moved across the width of the paper. Hence, the vertical movement of the paper and the horizontal movement of the pen create the required design under the control of the computer. Drum plotters can make multicolour drawings by using pens with different coloured inks. Moreover, drum plotters support very large plot sizes with paper widths of up to 1 meter.

Flatbed plotter In a flatbed plotter, the paper is spread on the flat rectangular surface of the plotter, and the pen is moved over it. Flatbed plotters are less expensive, and are used in many small computing systems. The size of the plot is limited only by the size of the plotter's bed. In this type of plotter, the paper does not move; rather, plotting is done by moving an arm that moves a pen over the paper.

In case of a flatbed plotter, pens of different colours are mounted in the pen-holding mechanism that moves on the surface. The microprocessor in the plotter selects the desired pen and controls its movement under the control of the computer.