UNIT-I

1.1-Graphics Primitives:

1.1.1- Introduction to computer graphics

Computers have become a powerful tool for the rapid and economical production of pictures. There is virtually no area in which graphical displays cannot be used to some advantage, and so it is not surprising to find the use of computer graphics so widespread. Although early applications in engineering and science had to rely on expensive and cumbersome equipment, advances in computer technology have made interactive computer graphics a practical tool.

1.1.2- Basics of Graphics systems

Let us consider the organization of a typical graphics system we might use. As our initial emphasis will be on how the applications programmer sees the system, we shall omit details of the hardware. A block diagram of our system is shown in fig 1.1. There are four key types of elements in our system:

. A processor
. Memory
. Output devices
. Input devices

The model is general enough to include workstations, personal computers, terminals attached to a central time-shared computer, and sophisticated image-generation systems. In most ways, this block diagram is that of a standard computer. How each element is specialized for computer graphics will characterize this diagram as one of a graphics system, rather than one of a general-purpose computer.

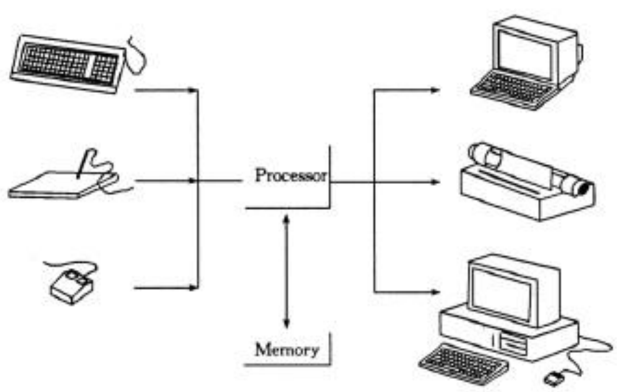


Fig. 1.1 A Computer Graphics System

1. The Processor: Within the processor box, two types of processing take place. The first is picture formation processing. In this stage, the user program or commands are processed. The picture is formed from the elements (lines, text) available in the system using the desired attributes such as line color and text font. The user interface is a part of this processing.

The picture can be specified in a number of ways, such as through an interactive menu-controlled painting program or via a C program using a graphics library. The physical processor used in this stage is often the processor in the workstation or host computer.

The second kind of processing is concerned with the display of the picture. In a raster system, the specified primitives must be scan converted. The screen must be refreshed to avoid flicker. Input from the user might require objects to be repositioned on the display. The kind of processor best suited for these jobs is not the standard type of processor found in most computers. Instead, special boards and chips are often used. As we have already noted, one of the elements that distinguishes real-time graphics systems is their use of display processors. Since we have agreed to stay at the block-diagram level for now, however, we shall not explore these architectures in any detail until later.

2. Memory: There are often two distinct types of memory employed in graphics systems. For the processing of the user program, the memory is similar to that of a standard computer, as the picture is formed by a standard type of arithmetic processing. Display processing, however, requires high-speed display memory that can be accessed by the display processor, and in raster systems, memory for the frame buffer. This display memory usually is different in both its physical characteristics and its organization from what is used by the picture processor. At this point, we need not consider details of how memory can be organized. You should be aware that the way the internals of our processor and memory boxes are organized distinguishes a slow system from a real-time picture-generating system, such as a flight simulator. However, from our present perspective, we shall emphasize that all implementations have to do the same kinds of tasks to produce output.

3. Output Devices: Our basic system has one or more output devices. As raster displays are the dominant type, we shall assume there is a raster-scan CRT on our system. We shall consider the frame buffer to be part of the display memory. In a self-contained system such as a workstation, the display is an integral part of the system, so the transfer of information from the processor to the display will happen rapidly. When the display is separate, such as with a graphics terminal, the speed of the connection is much slower. Terminals with raster displays usually must have their own frame buffers, so the displays can be refreshed locally. In our simple system, we might also have other displays, such as a plotter, to allow us to produce hardcopy.

4. Input Devices: A simple system may have only a keyboard to provide whatever input is necessary. Keyboards provide digital codes corresponding to sequences of keystrokes by a user. These sequences are usually interpreted as codes for characters. If individual keystrokes or groups of keystrokes are interpreted as graphical input, the keyborad can be used as a complex input device. For example, the "arrow" keys available on most keyboards can be used to direct the movement of a cursor on the screen. Most graphics systems will provide at least one other input device. The most common are the mouse, the lightpen, the joystick, and the data tablet. Each can provide positional information to the system and each usually is equipped with one or more buttons to provide signals to the processor.

From the programmer’s perspective, there are numerous important issues with regard to the input and output devices. We must consider how the program can communicate with these devices. We must decide what kinds of input and output can be produced. We will be interested in how to control multiple devices, so that we can choose a particular device for our input, and can direct our output to some group of the available output devices

1.1.3- Application areas of Computer Graphics

Today, we find computer graphics used routinely in such diverse areas as science, engineering, medicine, business, industry, government, art, entertainment, advertising, education, and training.

Almost any endeavor can make some use of computer graphics, but the major consumers of computer graphics technology include the following industries:

• **Video games** increasingly use sophisticated 3D models and rendering algorithms.

• **Cartoons** are often rendered directly from 3D models. Many traditional 2D cartoons use backgrounds rendered from 3D models, which allows a continuously moving viewpoint without huge amounts of artist time.

• **Visual effects** use almost all types of computer graphics technology. Almost every modern film uses digital compositing to superimpose backgrounds with separately filmed foregrounds. Many films also use 3D modeling and animation to create synthetic environments, objects, and even characters that most viewers will never suspect are not real.

• **Animated films** use many of the same techniques that are used for visual effects, but without necessarily aiming for images that look real.

• **CAD/CAM** stands for computer-aided design and computer-aided manufacturing. These fields use computer technology to design parts and products on the computer and then, using these virtual designs, to guide the manufacturing process. For example, many mechanical parts are designed in a 3D computer modeling package and then automatically produced on a computer-controlled milling device.

• **Simulation** can be thought of as accurate video gaming. For example, a flight simulator uses sophisticated 3D graphics to simulate the experience of flying an airplane. Such simulations can be extremely useful for initial training in safety-critical domains such as driving, and for scenario training for experienced users such as specific fire-fighting situations that are too costly or dangerous to create physically.

• **Medical imaging** creates meaningful images of scanned patient data. For example, a computed tomography (CT) dataset is composed of a large 3D rectangular array of density values. Computer graphics is used to create shaded images that help doctors extract the most salient information from such data.

• **Information visualization** creates images of data that do not necessarily have a “natural” visual depiction. For example, the temporal trend of the price of ten different stocks does not have an obvious visual depiction, but clever graphing techniques can help humans see the patterns in such data.

- **Computer graphics user interfaces** GUIsGUIs − A graphic, mouse-oriented paradigm which allows the user to interact with a computer.
- **Business presentation graphics** − "A picture is worth a thousand words".
- **Cartography** − Drawing maps.
- **Weather Maps** − Real-time mapping, symbolic representations.
- **Satellite Imaging** − Geodesic images.
- **Photo Enhancement** − Sharpening blurred photos.
- **Medical imaging** − MRIs, CAT scans, etc. - Non-invasive internal examination.
- **Engineering drawings** − mechanical, electrical, civil, etc. - Replacing the blueprints of the past.
- **Typography** − The use of character images in publishing - replacing the hard type of the past.
- **Architecture** − Construction plans, exterior sketches - replacing the blueprints and hand drawings of the past.
- **Art** − Computers provide a new medium for artists.
- **Training** − Flight simulators, computer aided instruction, etc.
- **Entertainment** − Movies and games.
- **Simulation and modeling** − Replacing physical modeling and enactments

1.2- Overview of graphics systems

Due to the widespread recognition of the power and utility of computer graphics in virtually all fields, a broad range of graphics hardware and software systems is now available. Graphics capabilities for both two-dimensional and three-dimensional applications are now common on general-purpose computers, including many hand-held calculators. With personal computers, we can use a wide variety of interactive input devices and graphics software packages. For higher quality applications, we can choose from a number of sophisticated special-purpose graphics hardware systems and technologies.

1.2.1- Video-display devices

Typically, the primary output device in a graphics system is a video monitor. The operation of most video monitors is based on the standard cathode-ray tube (CRT) design, but several other technologies exist and solid-state monitors may eventually predominate.

Refresh Cathode-Ray Tubes Fig. 1.1 illustrates the basic operation of a CRT. A beam of electrons (cathode rays), emitted by an electron gun, passes through focusing and deflection systems that direct the beam toward specified positions on the phosphor-coated screen. The phosphor then emits a small spot of light at each position contacted by the electron beam. Because the light emitted by the phosphor fades very rapidly, some method is needed for maintaining the screen picture. One way to keep the phosphor glowing is to redraw the picture repeatedly by quickly directing the electron beam back over the same points. This type of display is called a refresh CRT.

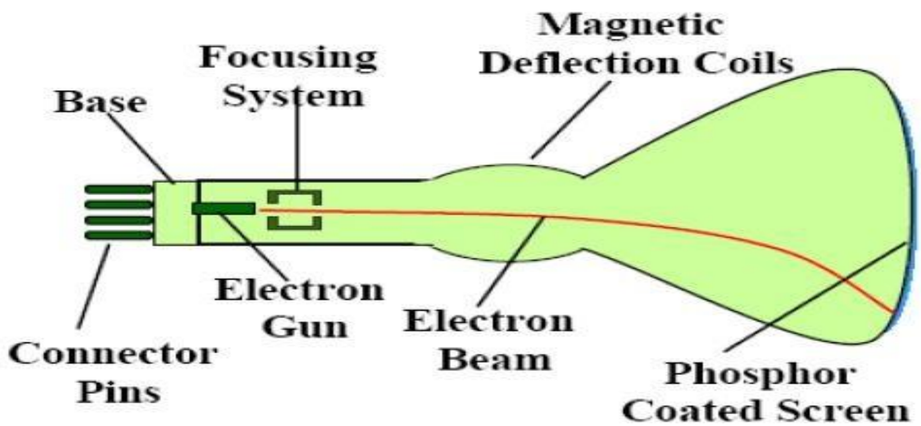


Figure 1.1 Basic design of a magnetic deflection CRT

The primary components of an electron gun in a CRT are the heated metal cathode and a control grid (Fig. 1.2). Heat is supplied to the cathode by directing a current through a coil of wire, called the filament, inside the cylindrical cathode structure. This causes electrons to be 'boiled off" the hot cathode surface. In the vacuum inside the CRT envelope, the free, negatively charged electrons are then accelerated toward the phosphor coating by a high positive voltage. The accelerating voltage can be generated with a positively charged metal coating on the inoverview of Graphics Systems side of the CRT envelope near the phosphor screen, or an accelerating anode can be used, as in Fig. 1.2. Sometimes the electron gun is built to contain the accelerating anode and focusing system within the same unit.

Intensity of the electron beam is controlled by setting voltage levels on the control grid, which is a metal cylinder that fits over the cathode. A high negative voltage applied to the control grid will shut off the beam by repelling electrons and stopping them from passing through the small hole at the end of the control grid structure. A smaller negative voltage on the control grid simply decreases the number of electrons passing through. Since the amount of light emitted by the phosphor coating depends on the number of electrons striking the screen, we control the brightness of a display by varying the voltage on the control grid

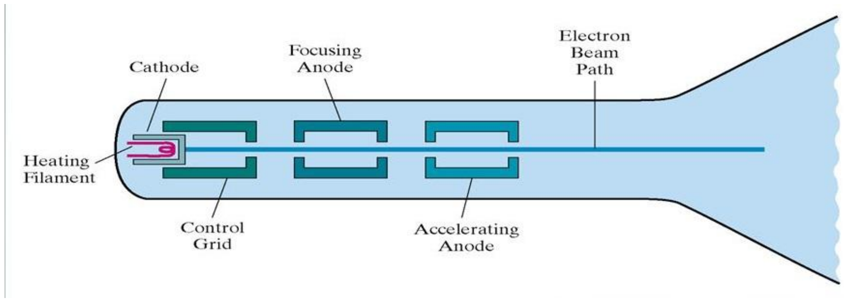


Fig.1.2 Operation of an electron gun with an accelerating anode

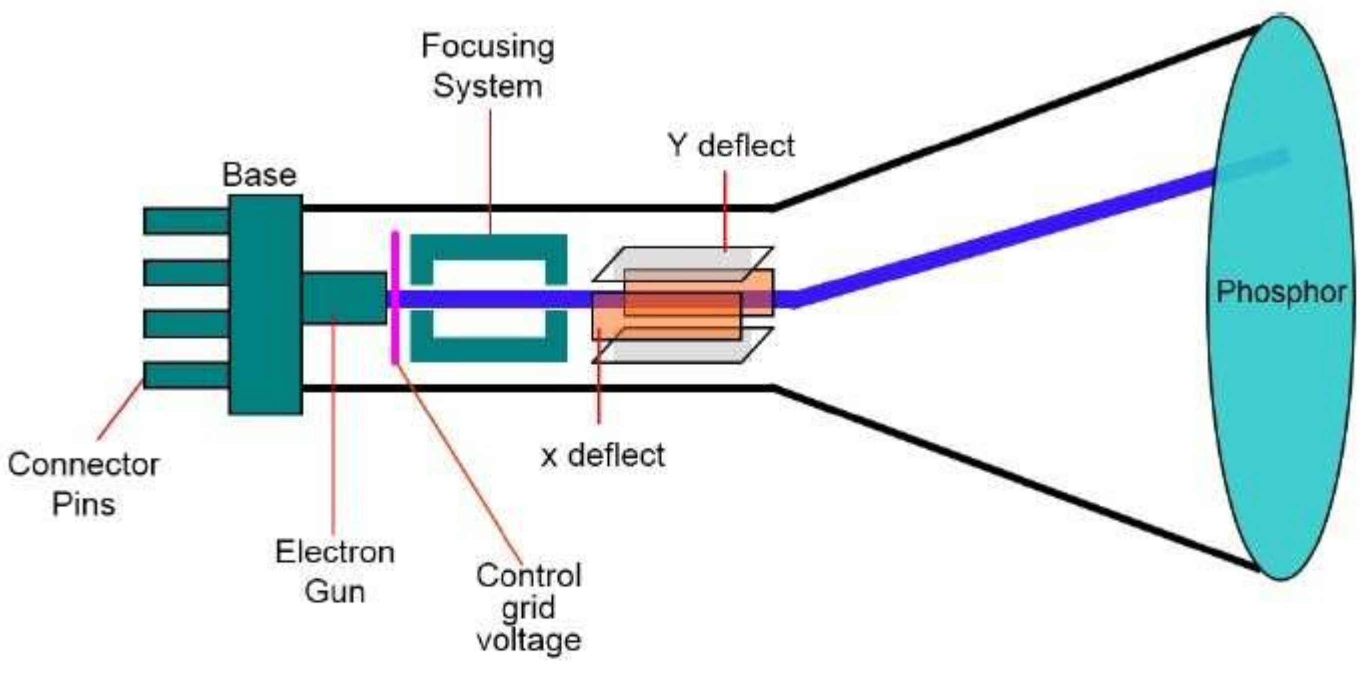
Computer graphics is an art of drawing pictures on computer screens with the help of programming. It involves computations, creation, and manipulation of data. In other words, we can say that computer graphics is a rendering tool for the generation and manipulation of images.

Cathode Ray Tube

The primary output device in a graphical system is the video monitor. The main element of a video monitor is the **Cathode Ray Tube** CRTCRT**,** shown in the following illustration.

The operation of CRT is very simple −

- The electron gun emits a beam of electrons cathoderayscathoderays.
- The electron beam passes through focusing and deflection systems that direct it towards specified positions on the phosphor-coated screen.
- When the beam hits the screen, the phosphor emits a small spot of light at each position contacted by the electron beam.
- It redraws the picture by directing the electron beam back over the same screen points quickly.



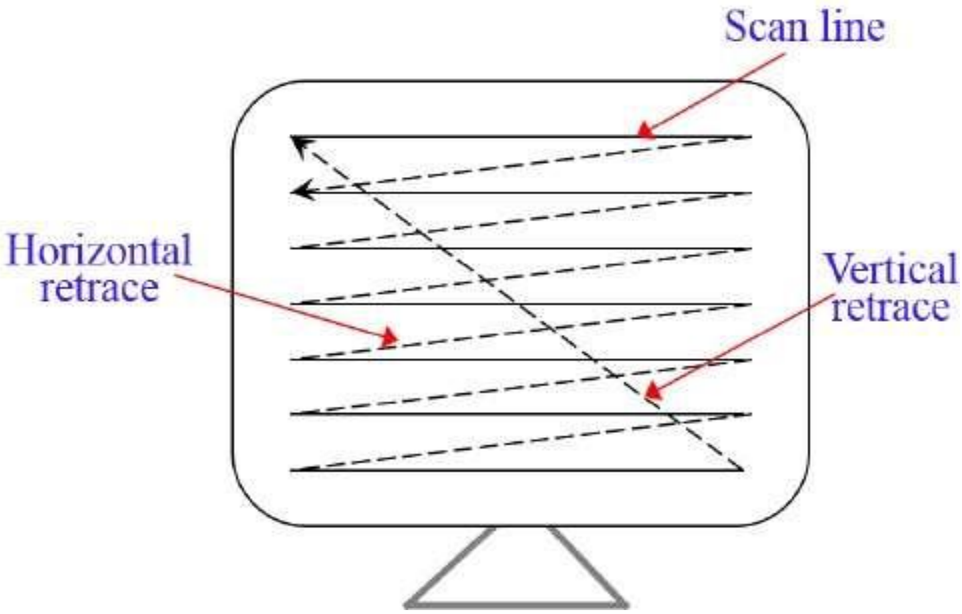
There are two ways Randomscan and Rasterscan by which we can display an object on the screen.

1.2.2- Raster-scan systems

Raster Scan

In a raster scan system, the electron beam is swept across the screen, one row at a time from top to bottom. As the electron beam moves across each row, the beam intensity is turned on and off to create a pattern of illuminated spots.

Picture definition is stored in memory area called the **Refresh Buffer** or **Frame Buffer**. This memory area holds the set of intensity values for all the screen points. Stored intensity values are then retrieved from the refresh buffer and "painted" on the screen one row scan line at a time as shown in the following illustration.
Each screen point is referred to as a **pixel** picture element or **pel**. At the end of each scan line, the electron beam returns to the left side of the screen to begin displaying the next scan line.



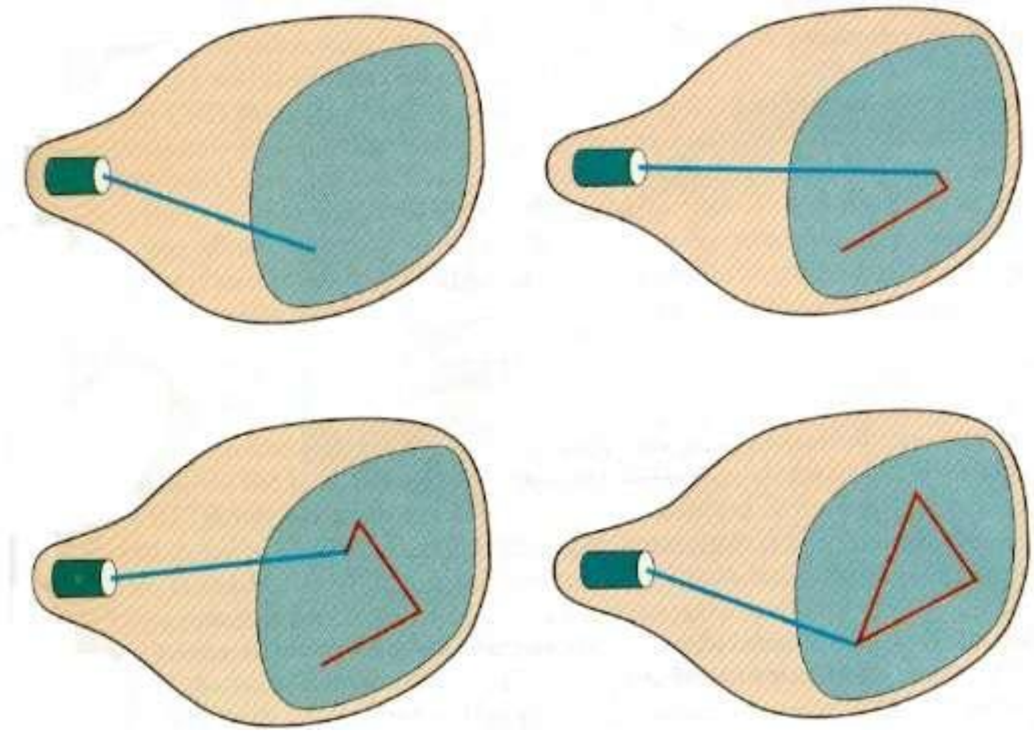
1.2.3- Random scan systems

Random Scan or Vector Scan

In this technique, the electron beam is directed only to the part of the screen where the picture is to be drawn rather than scanning from left to right and top to bottom as in raster scan. It is also called **vector display, stroke-writing display,** or **calligraphic display**.

Picture definition is stored as a set of line-drawing commands in an area of memory referred to as the **refresh display file**. To display a specified picture, the system cycles through the set of commands in the display file, drawing each component line in turn. After all the line-drawing commands are processed, the system cycles back to the first line command in the list.

Random-scan displays are designed to draw all the component lines of a picture 30 to 60 times each second.



1.2.4- Graphics monitors

Plasma displays are bright, have a wide color gamut, and can be produced in fairly large sizes, up to 262 cm (103 inches) diagonally. They have a very low-luminance “dark-room” black level, creating a black some find more desirable for watching movies. The display panel is only about 6 cm (2½ inches) thick, while the total thickness, including electronics, is less than 10 cm (4 inches).

Plasma displays use as much power per square meter as a CRT or an AMLCD television. Power consumption will vary greatly depending on what is watched on it. Bright scenes (say a football game) will draw significantly more power than darker scenes. The xenon and neon gas in a plasma television is contained in hundreds of thousands of tiny cells positioned between two plates of glass.

Long electrodes are also sandwiched between the glass plates, in front of and behind the cells. The address electrodes sit behind the cells, along the rear glass plate. The transparent display electrodes, which are surrounded by an insulating dielectric material and covered by a magnesium oxide protective layer, are mounted in front of the cell, along the front glass plate. Control circuitry charges the electrodes that cross paths at a cell, creating a voltage difference between front and back and causing the gas to ionize and form a plasma; as the gas ions rush to the electrodes and collide, photons are emitted.

In a monochrome plasma panel, the ionizing state can be maintained by applying a lowlevel voltage between all the horizontal and vertical electrodes – even after the ionizing voltage is removed. To erase a cell all voltage is removed from a pair of electrodes. This type of panel has inherent memory and does not use phosphors. A small amount of nitrogen is added to the neon to increase hysteresis. In color panels, the back of each cell is coated with a phosphor.

The ultraviolet photons emitted by the plasma excite these phosphors to give off colored light. The operation of each cell is thus comparable to that of a fluorescent lamp. Every pixel is made up of three separate sub pixel cells, each with different colored phosphors. One sub pixel has a red light phosphor, one sub pixel has a green light phosphor and one sub pixel has a blue light phosphor. These colors blend together to create the overall color of the pixel, analogous to the “triad” of a shadowmask CRT.

Thin film electro-luminescent display

Electroluminescence is the result of radiative recombination of electrons and holes in a material (usually a semiconductor). The excited electrons release their energy as photons – light. Prior to recombination, electrons and holes are separated either as a result of doping of the material to form a p-n junction (in semiconductor electroluminescent devices such as LEDs), or through excitation by impact of high-energy electrons accelerated by a strong electric field (as with the phosphors in electroluminescent displays).

Powder phosphor-based electroluminescent panels are frequently used as backlights to liquid crystal displays. They readily provide a gentle, even illumination to the entire display while consuming relatively little electric power. They do, however, require relatively high voltage. Recently, blue, red and green emitting thin film electroluminescent materials have been developed that offer the potential for long life and full color electroluminescent displays. In either case, the EL material must be enclosed between two electrodes and at least one electrode must be transparent to allow the escape of the produced light.

Glass coated with indium oxide or tin oxide is commonly used as the front (transparent) electrode while the back electrode is or is coated with reflective metal. Additionally, other transparent conducting materials, such as carbon nanotubes coatings or PEDOT can be used as the front electrode. Unlike neon and fluorescent lamps, EL lamps are not negative resistance devices so no extra circuitry is needed to regulate the amount of current flowing through them. In principle, EL lamps can be made in any color. EL devices have low power consumption when compared with neon signs, and have a wide range of applications such as their use on advertising boards and safety signs.

Liquid Crystal Display (LCD)

An active matrix liquid crystal display (AMLCD) is a type of flat panel display, currently the overwhelming choice of notebook computer manufacturers, due to light weight, very good image quality, wide color gamut, and response time. The most common example of an active matrix display contains, besides the polarizing sheets and cells of liquid crystal, a matrix of thin-film transistors (TFTs) to make a TFT LCD.

Each pixel of an LCD typically consists of a layer of molecules aligned between two transparent electrodes, and two polarizing filters, the axes of transmission of which are (in most of the cases) perpendicular to each other. With no liquid crystal between the polarizing filters, light passing through the first filter would be blocked by the second (crossed) polarizer. The surface of the electrodes that are in contact with the liquid crystal material are treated so as to align the liquid crystal molecules in a particular direction. This treatment typically consists of a thin polymer layer that is unidirectionally rubbed using, for example, a cloth.

The direction of the liquid crystal alignment is then defined by the direction of rubbing. When a voltage is applied across the electrodes, a torque acts to align the liquid crystal molecules parallel to the electric field, distorting the helical. This reduces the rotation of the polarization of the incident light, and the device appears gray. If the applied voltage is large enough, the liquid crystal molecules in the center of the layer are almost completely untwisted and the polarization of the incident light is not rotated as it passes through the liquid crystal layer. This light will then be mainly polarized perpendicular to the second filter, and thus be blocked and the pixel will appear black.

By controlling the voltage applied across the liquid crystal layer in each pixel, light can be allowed to pass through in varying amounts thus constituting different levels of gray. Both the liquid crystal material and the alignment layer material contain ionic compounds. If an electric field of one particular polarity is applied for a long period of time, this ionic material is attracted to the surfaces and degrades the device performance.

This is avoided either by applying an alternating current or by reversing the polarity of the electric field as the device is addressed. When a large number of pixels is required in a display, it is not feasible to drive each directly since then each pixel would require independent electrodes. Instead, the display is multiplexed. In a multiplexed display, electrodes on one side of the display are grouped and wired together (typically in columns), and each group gets its own voltage source. On the other side, the electrodes are also grouped (typically in rows), with each group getting a voltage sink.

L**ight-emitting diode** (**LED**) is a semiconductor diode that emits incoherent narrow-spectrum light when electrically biased in the forward direction of the p-n junction. This effect is a form of electroluminescence. An LED is usually a small area source, often with extra optics added to the chip that shapes its radiation pattern. The color of the emitted light depends on the composition and condition of the semi conducting material used, and can be infrared, visible, or near-ultraviolet. An LED can be used as a regular household light source.

Like a normal diode, an LED consists of a chip of semi conducting material impregnated, or *doped*, with impurities to create a *p-njunction*. As in other diodes, current flows easily from the p-side, or anode, to the n-side, or cathode, but not in the reverse direction. Charge-carriers—electrons and holes—flow into the junction from electrodes with different voltages. When an electron meets a hole, it falls into a lower energy level, and releases energy in the form of a photon. The wavelength of the light emitted, and therefore its color, depends on the band gap energy of the materials forming the *p-n junction*.

In silicon or germanium diodes, the electrons and holes recombine by a *non-radiative transition* which produces no optical emission, because these are indirect band gap materials. The materials used for an LED have a direct band gap with energies corresponding to near-infrared, visible or near-ultraviolet light. LEDs are usually built on an n-type substrate, with an electrode attached to the ptype layer deposited on its surface.

P-type substrates, while less common, occur as well. Many commercial LEDs, especially GaN/InGaN, also use sapphire substrate. Substrates that are transparent to the emitted wavelength, and backed by a reflective layer, increase the LED efficiency. The refractive index of the package material should match the index of the semiconductor, otherwise the produced light gets partially reflected back into the semiconductor, where it may be absorbed and turned into additional heat, thus lowering the efficiency. An anti-reflection coating may be added as well.

1.2.5- Workstations

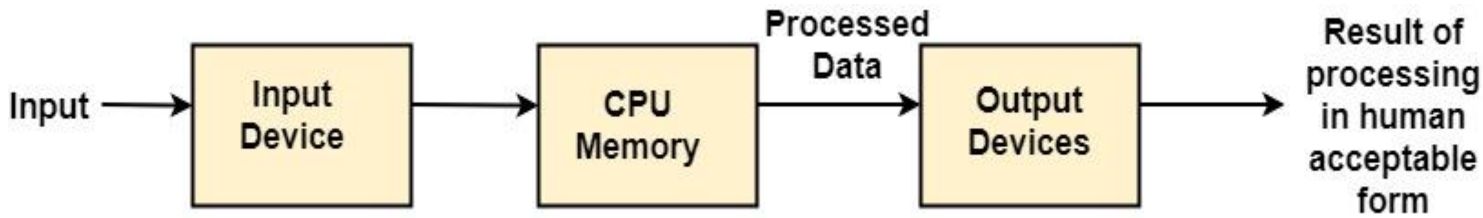
workstation, a high-performance computer system that is basically designed for a single user and has advanced graphics capabilities, large storage capacity, and a powerful central processing unit. A workstation is more capable than a personal computer (PC) but is less advanced than a server (which can manage a large network of peripheral PCs or workstations and handle immense data-processing and reporting tasks). The term *workstation* was also sometimes ascribed to dumb terminals (i.e., those without any processing capacity) that were connected to mainframe computers.

Their raw processing power allows high-end workstations to accommodate high-resolution or three-dimensional graphic interfaces, sophisticated multitask software, and advanced abilities to communicate with other computers. Workstations are used primarily to perform computationally intensive scientific and engineering tasks. They have also found favor in some complex financial and business applications. In addition, high-end workstations often serve a network of attached “client” PCs, which use resident tools and applications to access and manipulate data stored on the workstation.

The chief delineation between PCs and workstations has traditionally been the latter’s advanced graphics and data-processing capabilities. But the advanced graphic interfaces and powerful microprocessors of high-end PCs can make them barely distinguishable from low-end workstations.

1.2.6- Input devices

The Input Devices are the hardware that is used to transfer transfers input to the computer. The data can be in the form of text, graphics, sound, and text. Output devices display data from the memory of the computer. Output can be text, numeric data, line, polygon, and other objects.



These Devices include:

1. Keyboard
2. Mouse
3. Trackball
4. Spaceball
5. Joystick
6. Light Pen
7. Digitizer
8. Touch Panels
9. Voice Recognition
10. Image Scanner

Keyboard:

The most commonly used input device is a keyboard. The data is entered by pressing the set of keys. All keys are labeled. A keyboard with 101 keys is called a QWERTY keyboard.
The keyboard has alphabetic as well as numeric keys. Some special keys are also available.

1. **Numeric Keys:** 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
2. **Alphabetic keys:** a to z (lower case), A to Z (upper case)
3. **Special Control keys:** Ctrl, Shift, Alt
4. **Special Symbol Keys:** ; , " ? @ ~ ? :
5. **Cursor Control Keys:** ↑ → ← ↓

6. **Function Keys:** F1 F2 F3....F9.
7. **Numeric Keyboard:** It is on the right-hand side of the keyboard and used for fast entry of numeric data.

Function of Keyboard:

1. Alphanumeric Keyboards are used in CAD. (Computer Aided Drafting)
2. Keyboards are available with special features line screen co-ordinates entry, Menu selection or graphics functions, etc.
3. Special purpose keyboards are available having buttons, dials, and switches. Dials are used to enter scalar values. Dials also enter real numbers. Buttons and switches are used to enter predefined function values.

Advantage:

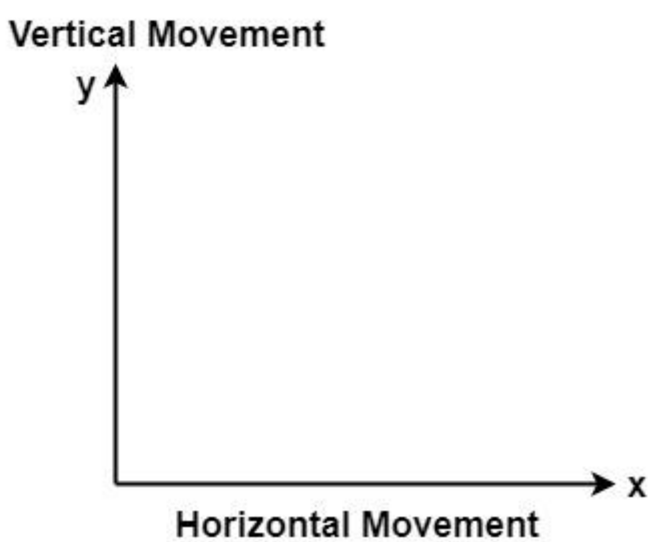
1. Suitable for entering numeric data.
2. Function keys are a fast and effective method of using commands, with fewer errors.

Disadvantage:

1. Keyboard is not suitable for graphics input.

Mouse:

A Mouse is a pointing device and used to position the pointer on the screen. It is a small palm size box. There are two or three depression switches on the top. The movement of the mouse along the x-axis helps in the horizontal movement of the cursor and the movement along the y-axis helps in the vertical movement of the cursor on the screen. The mouse cannot be used to enter text. Therefore, they are used in conjunction with a keyboard.

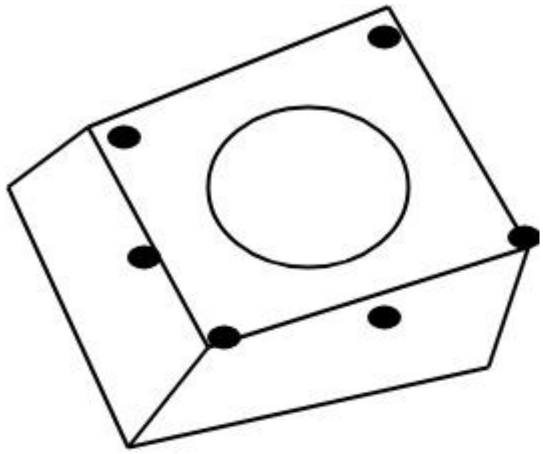


Advantage:

1. Easy to use
2. Not very expensive

Trackball

It is a pointing device. It is similar to a mouse. This is mainly used in notebook or laptop computer, instead of a mouse. This is a ball which is half inserted, and by changing fingers on the ball, the pointer can be moved.



TrackBall

Advantage:

1. Trackball is stationary, so it does not require much space to use it.
2. Compact Size

Spaceball:

It is similar to trackball, but it can move in six directions where trackball can move in two directions only. The movement is recorded by the strain gauge. Strain gauge is applied with pressure. It can be pushed and pulled in various directions. The ball has a diameter around 7.5 cm. The ball is mounted in the base using rollers. One-third of the ball is an inside box, the rest is outside.

Applications:

1. It is used for three-dimensional positioning of the object.
2. It is used to select various functions in the field of virtual reality.
3. It is applicable in CAD applications.
4. Animation is also done using spaceball.
5. It is used in the area of simulation and modeling.

Joystick:

A Joystick is also a pointing device which is used to change cursor position on a monitor screen. Joystick is a stick having a spherical ball as its both lower and upper ends as shown in fig. The lower spherical ball moves in a socket. The joystick can be changed in all four directions. The function of a joystick is similar to that of the mouse. It is mainly used in Computer Aided Designing (CAD) and playing computer games.

Light Pen

Light Pen (similar to the pen) is a pointing device which 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 its tip is moved over the monitor screen, and pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signals to the CPU.

Light Pen

Uses:

1. Light Pens can be used as input coordinate positions by providing necessary arrangements.
2. If background color or intensity, a light pen can be used as a locator.
3. It is used as a standard pick device with many graphics system.
4. It can be used as stroke input devices.
5. It can be used as valuators

Digitizers:

The digitizer is an operator input device, which contains a large, smooth board (the appearance is similar to the mechanical drawing board) & an electronic tracking device, which can be changed over the surface to follow existing lines. The electronic tracking device contains a switch for the user to record the desire x & y coordinate positions. The coordinates can be entered into the computer memory or stored or an off-line storage medium such as magnetic tape.

Digitizer

Advantages:

1. Drawing can easily be changed.
2. It provides the capability of interactive graphics.

Disadvantages:

1. Costly
2. Suitable only for applications which required high-resolution graphics.

Touch Panels:

Touch Panels is a type of display screen that has a touch-sensitive transparent panel covering the screen. A touch screen registers input when a finger or other object comes in contact with the screen.

When the wave signals are interrupted by some contact with the screen, that located is recorded. Touch screens have long been used in military applications.

Voice Systems (Voice Recognition):

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. The simplest form of voice recognition is a one-word command spoken by one person. Each command is isolated with pauses between the words.

Voice Recognition is used in some graphics workstations as input devices to accept voice commands. The voice-system input can be used to initiate graphics operations or to enter data. These systems operate by matching an input against a predefined dictionary of words and phrases.

Advantage:

1. More efficient device.
2. Easy to use
3. Unauthorized speakers can be identified

Disadvantages:

1. Very limited vocabulary
2. Voice of different operators can't be distinguished.

Image Scanner

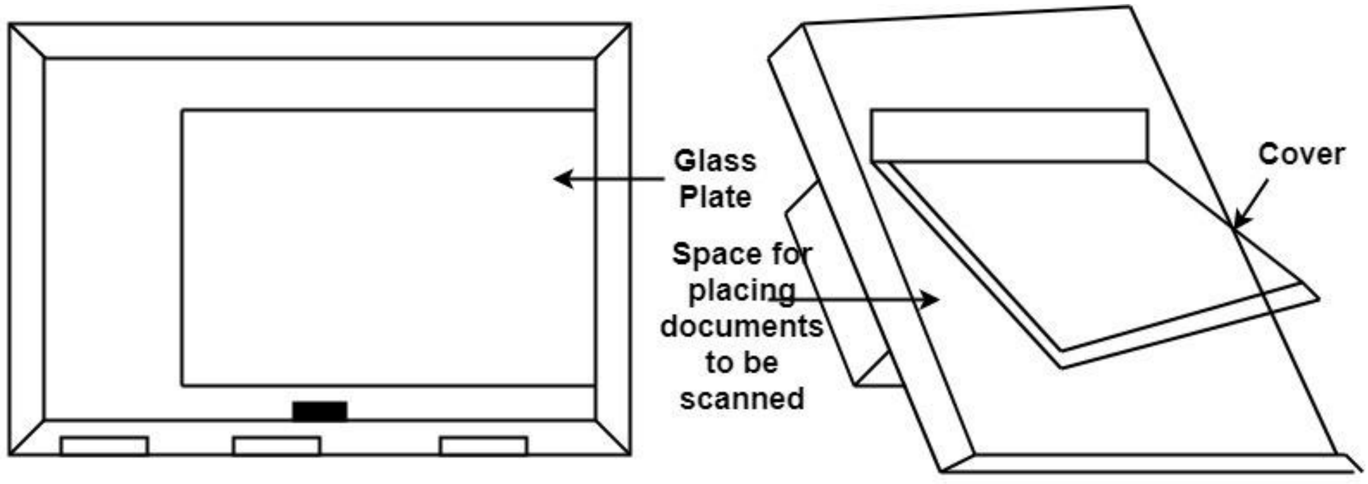
It is an input device. The data or text is written on paper. The paper is feeded to scanner. The paper written information is converted into electronic format; this format is stored in the computer. The input documents can contain text, handwritten material, picture extra.

By storing the document in a computer document became safe for longer period of time. The document will be permanently stored for the future. We can change the document when we need. The document can be printed when needed.

Scanning can be of the black and white or colored picture. On stored picture 2D or 3D rotations, scaling and other operations can be applied.

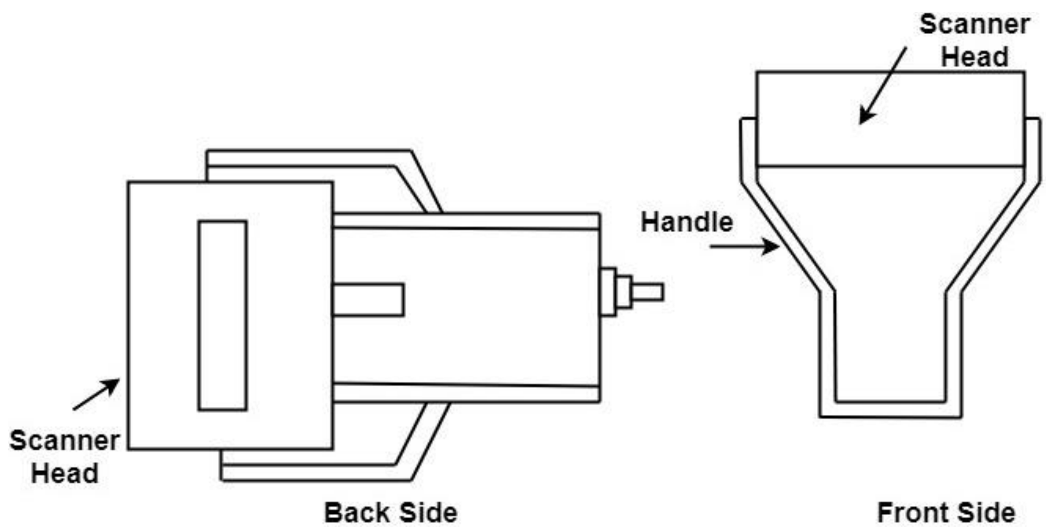
Types of image Scanner:

1. Flat Bed Scanner: It resembles a photocopy machine. It has a glass top on its top. Glass top in further covered using a lid. The document to be scanned is kept on glass plate. The light is passed underneath side of glass plate. The light is moved left to right. The scanning is done the line by line. The process is repeated until the complete line is scanned. Within 20-25 seconds a document of 4" * 6" can be scanned.



Flat Bed Scanner

2. Hand Held Scanner: It has a number of LED's (Light Emitting Diodes) the LED's are arranged in the small case. It is called a Hand held Scanner because it can be kept in hand which performs scanning. For scanning the scanner is moved over document from the top towards the bottom. Its light is on, while we move it on document. It is dragged very slowly over document. If dragging of the scanner over the document is not proper, the conversion will not correct.



Hand Held Scanner

1.3-Output Primitives:

1.3.1- Points and lines

1.3.2- line drawing algorithms

1.3.3- mid-point

1.3.4- circle

1.3.5- ellipse algorithms.

1.4-Filled area primitives:

1.4.1- Scan line polygon fill algorithm

1.4.2- boundary fill algorithm

1.4.3- flood-fill algorithms

***Some Hot Topics/ keyword of Uinit-1**

Phosphorescence is luminescence that occurs when energy is supplied by electromagnetic radiation, usually ultraviolet light. The energy source kicks an electron of an atom from a lower energy state into an "excited" higher energy state; then the electron releases the energy in the form of visible light (luminescence) when it falls back to a lower energy state.

Key Takeaways: Phosphorescence

- Phosphorescence is a type of photoluminescence.
- In phosphorescence, light is absorbed by a material, bumping up the energy levels of electrons into an excited state. However, the energy of the light doesn't quite match up with the energy of allowed excited states, so the absorbed photos get stuck in a triplet state. Transitions to a lower and more stable energy state take time, but when they occur, light is released. Because this release occurs slowly, a phosphorescent material appears to glow in the dark.
- Examples of phosphorescent materials include glow-in-the-dark stars, some safety signs, and glowing paint. Unlike phosphorescent products, fluorescent pigments stop glowing once the light source is removed.
- Although named for the green glow of the element phosphorus, phosphorus actually glows because of oxidation. It is not phosphorescent!

Simple Explanation

Phosphorescence releases the stored energy slowly over time. Basically, phosphorescent material is "charged" by exposing it to light. Then the energy is stored for a period of time and slowly released. When the energy is released immediately after absorbing the incident energy, the process is called fluorescence.

Quantum Mechanics Explanation

In fluorescence, a surface absorbs and re-emits a photon almost instantly (about 10 nanoseconds). Photoluminescence is quick because the energy of the absorbed photons matches energy states and allowed transitions of the material. Phosphorescence lasts much longer (milliseconds up to days) because the absorbed electron crosses into an excited state with higher spin multiplicity. The excited electrons get trapped in a triplet state and can only use "forbidden" transitions to drop to a lower energy singlet state. Quantum mechanics allows for forbidden transition, but they are not kinetically favorable, so they take longer to occur. If enough light is absorbed, the stored and released light becomes sufficiently significant for material to appear to "glow in the dark." For this reason, phosphorescent materials, like fluorescent materials, appear very bright under a black (ultraviolet) light. A Jablonski diagram is commonly used to display the difference between fluorescence and phosphorescence.

This Jablonski diagram shows the difference between the mechanisms of fluorescence and phosphorescence. Smokefoot / Creative Commons Attribution-Share Alike 3.0

History

The study of phosphorescent materials dates back to at least 1602 when Italian Vincenzo Casciarolo described a "lapis solaris" (sun stone) or "lapis lunaris" (moon stone). The discovery was described in philosophy professor Giulio Cesare la Galla's 1612 book *De Phenomenis in Orbe Lunae*. La Galla reports Casciarolo's stone emitted light on it on after it had been calcified through heating. It received light from the Sun and then (like the Moon) gave out light in the darkness. The stone was impure barite, although other minerals also display phosphorescence. They include some diamonds (known to Indian king Bhoja as early as 1010-1055, rediscovered by Albertus Magnus and again rediscovered by Robert Boyle) and white topaz. The Chinese, in particular, valued a type of fluorite called chlorophane that would display luminescence from body heat, exposure to light, or being rubbed. Interest in the nature of phosphorescence and other types of luminescence eventually led to the discovery of radioactivity in 1896.

Materials

Besides a few natural minerals, phosphorescence is produced by chemical compounds. Probably the best-known of these is zinc sulfide, which has been used in products since the 1930s. Zinc sulfide usually emits a green phosphorescence, although phosphors may be added to change the color of light. Phosphors absorb the light emitted by phosphorescence and then release it as another color.

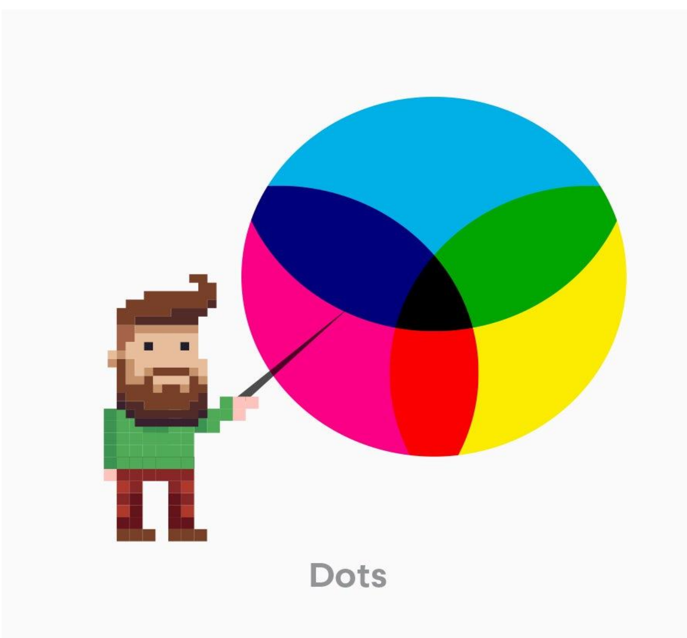
More recently, strontium aluminate is used for phosphorescence. This compound glows ten-time brighter than zinc sulfide and also stores its energy much longer.

Examples of Phosphorescence

Common examples of phosphorescence include stars people put on bedroom walls that glow for hours after the lights are turned out and paint used to make glowing star murals. Although the element phosphorus glows green, the light is released from oxidation (chemiluminescence) and is *not* an example of phosphorescence.

What DPI means

DPI, or dots per inch, refers to the resolution value of a physical printer. Printers reproduce an image by spitting out tiny dots, and the number of dots per inch affects the amount of detail and overall quality of the print.



Printer dots mix CMYK inks

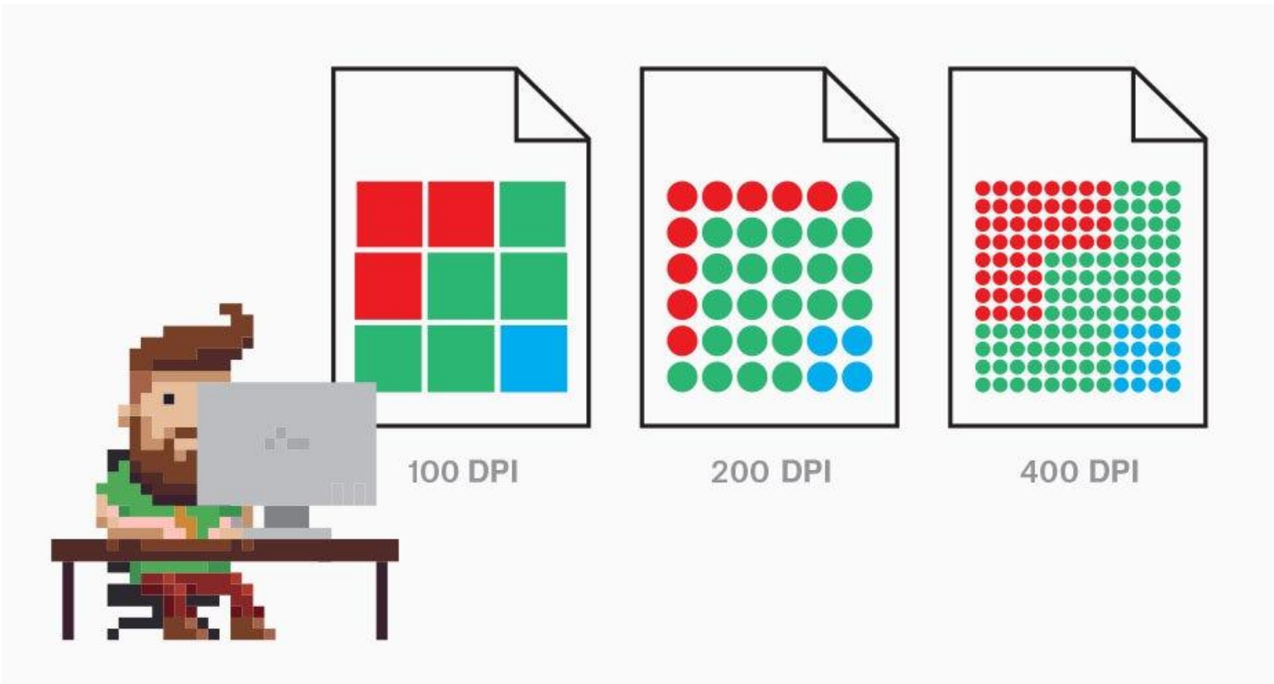
DPI describes the amount of detail in an image

based on the concentration of printer dots

DPI uses the CMYK (cyan, magenta, yellow and key/black) color model to control the amount of red, green, and blue light that is reflected from white paper. This is also known as the subtractive color model. Dots of each color are printed in patterns, enabling the human eye to perceive a specific color made from this combination. DPI is a measurement of this density. These dots are a fixed size and resolution is only affected by how many dots appear per inch.

When do you use DPI?

When your design is going to be physically printed, the printer will use DPI. Each model and style of printer produces its own unique DPI based on its settings. Inkjet printers produce a resolution around 300 to 720 DPI, while laser printers produce images anywhere from 600 to 2,400 DPI.



Higher DPI can mean higher resolution, but dot sizes vary by printer

There is no standard dot size or shape, so higher DPI does not always equate to a higher quality print. One manufacturer's dots might look as good at 1200 DPI as another manufacturer's dots do at 700 DPI. Books and magazines often use 150 DPI for photographic reproduction, and newspapers often use 85 DPI. Ask the printshop or consult the printer specifications to find the appropriate DPI for your project.

BCA-302: Computer Graphics

UNIT-I

Graphics Primitives: Introduction to computer graphics, Basics of Graphics systems, Application areas of Computer Graphics

Overview of graphics systems: Video-display devices, and raster-scan systems, random scan systems, graphics monitors and workstations and input devices.

Output Primitives: Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms.

Filled area primitives: Scan line polygon fill algorithm, boundary fill and flood- fill algorithms

UNIT-II

2-D Geometrical Transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems. 2-D Viewing: The viewing pipeline, viewing coordinate reference frame, window to viewport coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

UNIT-III

3-D Object Representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon-rendering methods.

UNIT-IV

3-D Geometric Transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations. 3-D Viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.