BTME 3060
Computer Aided Design
Lecture 6

2nd Year

III Semester

Galgotias University

2020-21

Unit I: Introduction to CAD

- Syllabus
  - Product Development Cycle
  - Introduction to CAD, Hardware and software requirement of CAD;
  - Graphics input devices- cursor control devices, Digitizers, Scanners, speech oriented devices and touch panels,
  - Graphics display devices- Refresh cathode ray tubes, Raster-scan displays, Random-scan displays, CRT Monitors;
  - Input devices- keyboard, joy-stick, mouse, scanner;
  - **DVST, Flat- panel display, Hard copy devices - Printers and Plotters, dot matrix, inkjet, laser printers**,
  - Graphics Standards – Neutral File formats –IGES, STEP,
  - Graphics software, Graphics functions,
  - output primitives- Bresenham's Algorithm and DDA.

Objective of the lecture

- understanding of DVST, Flat- panel display.

- How the Hard copy devices - Printers and Plotters, dot matrix, inkjet, laser printers works

Direct View Storage Tube

- Direct View Storage Tube (DVST) resembles CRT as it uses electron gun to draw picture and phosphor coated screen to display it.

- The phosphor used in this is of high persistence.

- DVST does not use refresh buffer or frame buffer to store picture definition.

- Picture definition is stored in inside CRT in form positive charged distribution.

- Because of this reason DVST is knows as Storage Type CRT.

- In DVST no refreshing is required as result picture drawn on DVST will be seen for several minutes before fading.

Various components of DVST :

- **Electron guns –**
Two electron guns are used in DVST : Primary Gun and Flood Gun. Primary gun is used to store picture pattern. Flood gun is used to maintain picture display on phosphor coated screen.

- **Phosphor Coated Screen –**
In DVST the inner surface of CRT is coated with phosphor crystals is of high persistence that emit light when beam of electrons strike them.

- **Storage Mesh –**
It is thin and high quality wire that is coated with dielectric and is located just behind phosphor coated screen. Primary gun deposits pattern of positive charge on this grid and it is transferred to phosphor coated screen by continuous flood of electrons produced by flood gun. Thus Storage Mesh stores picture to be displayed in form of positive charge distribution.

- **Collector –**
This grid is located just behind storage mesh and purpose of this negatively charged grid is to smooth out flow of flood electrons.

Working principle of DVST :

- n DVST similar with CRT electron gun and phosphor coated method is used.

- But in this no electron beam is used to directly writing pictures on screen, but instead of this we can used Storage mesh wire grid is used it is just located behind phosphor coated screen.

- Their is also another grid located just behind storage mesh is called Collector and this purpose is to smooth out flow of flood electrons.

- The flood gun produce large number of electrons, this negatively charged grid reduces speed of these electrons.

- Then electrons pass through collector at low velocity and attracted by positive charged portions of storage mesh and strike at portions of phosphor coated screen to display picture.

- Some electrons get repelled by other portions of mesh that are negatively charged.

- Since the collector has slowly down electrons, in this way they not able to produce sharpened images.

- So to reduce this problem, screen itself is maintained at a high positive potential by means of voltage applied to thin aluminum coating between tube face and phosphor.
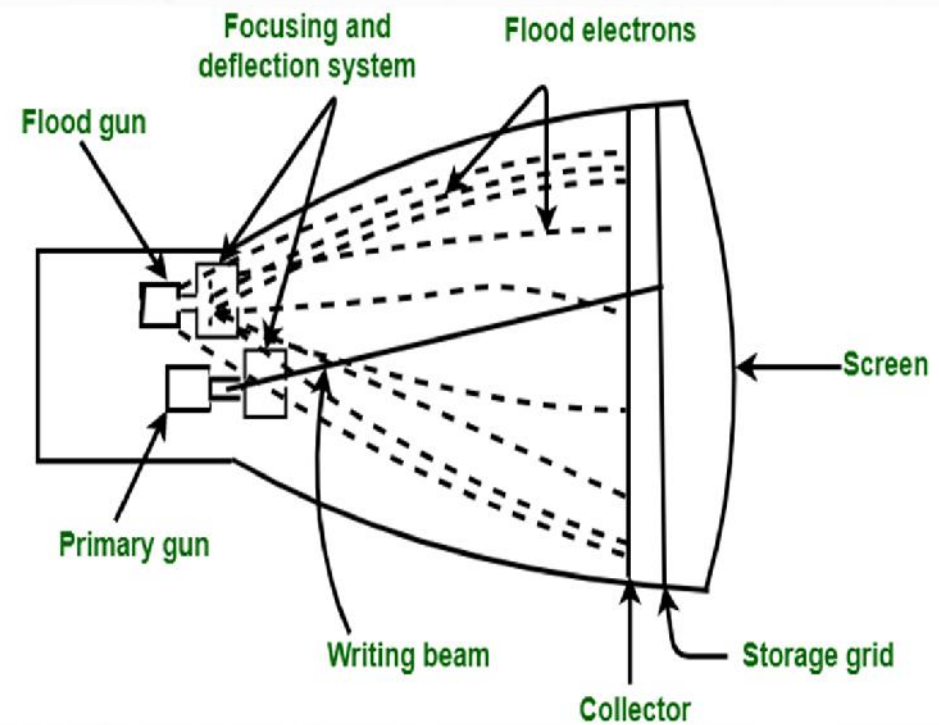
Contd..

- Advantage:
  - No refreshing is needed.
  - High Resolution
  - Cost is very less

- Disadvantage:
  - It is not possible to erase the selected part of a picture.
  - It is not suitable for dynamic graphics applications.
 - If a part of picture is to modify, then time is consumed.

Flat- panel display

- Flat-Panel Devices are the devices that have less volume, weight, and power consumption compared to Cathode Ray Tube (CRT).

- Due to the advantages of the Flat-Panel Display, use of CRT decreased.

- As Flat Panel Devices are light in weights that's why they can be hang on walls and wear them on our wrist as a watch.

- Flat Panel Display (FPD) allow users to view data, graphics, text and images.

Types of Flat Panel Display:

- Emissive Display:
  - The Emissive Display or Emitters are the devices that convert electrical energy into light energy.
  - Examples: Plasma Panel, LED (Light Emitting Diode), Flat CRT.

- Non-Emissive Display:
  - Non-Emissive Display or Non-Emitters are the devices that use optical effects to convert sunlight or some other source into graphic patterns.
  - Examples: LCD (Liquid Crystal Display)
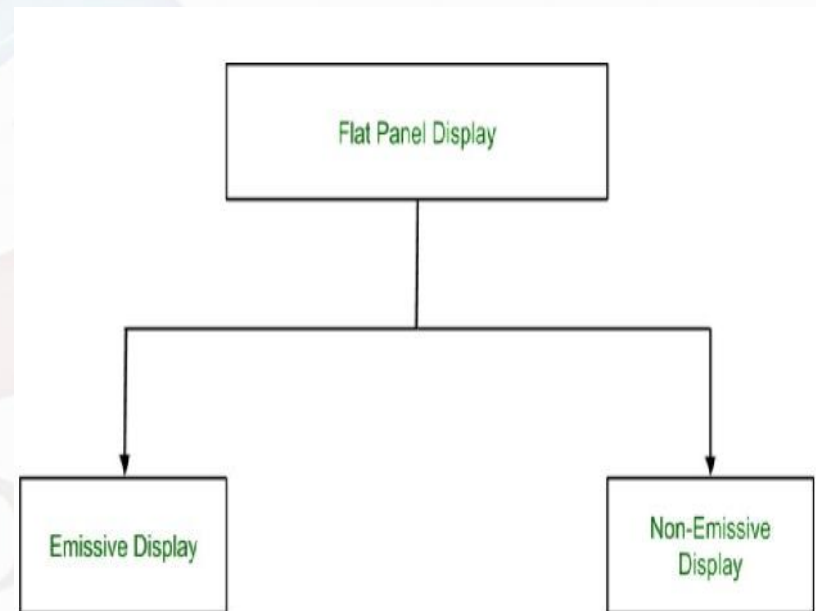
Advantages of Flat Panel Devices:

- Flat Panel Devices like LCD produces high quality digital images.

- Flat Panel monitor are stylish and have very space saving design.

- Flat Panel Devices consumes less power and give maximum image size in minimum space.

- Flat Panel Devices use its full color display capability.

- Full motion video can be viewed on Flat Panel Devices without artifacts or contrast loss.

Hard copy devices - Printers and Plotters

- **Hard copy devices** are those that give the output in the tangible form. Printers and Plotters are two common hard copy devices.

- Printers -All the printers irrespective of the technology used can be categorised as
  - Impact Printers
  - Non Impact Printers

- Impact printers are those printers in which there is a direct contact between the printing head and the paper on which the print is produced.
  - They work by striking a head or a needle against an inked ribbon which leaves a mark on the paper.
  - These printers produce a lot of noise when printing, because of the head striking the paper.
  - Examples are Dot Matrix, Daisy Wheel and Line printers.

- non-impact printers the printing head never comes in direct contact with the paper.
  - These printers work by spraying ink on the paper.
  - Electrostatic or electromagnetic charge is used in these printers.
  - Examples are Ink-Jet and Laser printers.

Dot Matrix is an impact printer.

- These printer forms characters from individual dots.

- These printers have a print head which runs back and forth on a paper.

- The print head has a two-dimensional array of pins called dot matrix. There may be 9 to 24 pins in the dot matrix.

- From this array of pins some pins are drawn out (or driven forward) to form the shape of a character.

- The drawn out pins strike an ink soaked cloth ribbon against a paper. This forms that particular character on the paper.

- Thus dot matrix printers can be used to print different fonts of characters.

- Since mechanical force is used, carbon copies of documents can be taken.

- 40 to 250 characters can be printed per second.

Inkjet printer is a non impact printer,

- The print head contains an ink cartridge which has a series of nozzles that are used to spray tiny drops of ink on to the paper.

- Ink cartridges come in various combinations, such as separate black and colour cartridges, colour and black in a single cartridge or even a cartridge for each ink colour.

- A motor moves the print head back and forth across the paper.

- Different types of inkjet printers form their droplets of ink in different ways. There are two main inkjet technologies currently used by printer manufacturers

Types of Ink-jet printers

- Thermal bubble –
  - This method is commonly referred to as bubble jet.
  - In a thermal inkjet printer, tiny resistors create heat, and this heat vaporizes ink to create a bubble.
  - As the bubble expands, some of the ink is pushed out of a nozzle onto the paper. When the bubble "pops" (collapses), a vacuum is created.
  - This pulls more ink into the print head from the cartridge. A typical bubble jet print head has 300 or 600 tiny nozzles, and all of them can fire a droplet simultaneously.

- Piezoelectric –
  - This technology uses piezo crystals.
  - A crystal is located at the back of the ink reservoir of each nozzle.
  - The crystal receives a tiny electric charge that causes it to vibrate.
  - When the crystal vibrates inward, it forces a tiny amount of ink out of the nozzle.
  - When it vibrates out, it pulls some more ink into the reservoir to replace the ink sprayed out.

A laser printer is a non impact printer

- Laser printer uses the principle of Static Electricity to print.

- This printer has revolving cylinder called Drum.

- Drum is given a positive charge.

- A Laser beam is used to draw the image to be printed, on the drum with negative charge. This discharges some portion of the charge on the drum. This creates electrostatic image of the print on the drum with no charge, and the background is left positively charged.

- The drum is then exposed to toner from which positively charged toner particles mixed with carbon black are released. Since positive charge repels positive charge, the toner particles settles on the discharged areas of the drum, this is exactly the image to be printed.

- The paper is then pressed against the drum, this transfers the toner particles on to the paper.

- Paper is then passed through a fuser, which is a set of heated rollers, this melts the carbon black on the paper to form the desired print.

Plotters :

- Another hard copy output device is plotter. Plotter is a printing device which can draw continuous lines. This is useful to print vector graphics rather than raster graphics unlike normal printers. Plotters are widely used in applications like CAD.

- Plotters print by moving one or more pen across the surface of a piece of paper. This means that plotters are restricted to line art, rather than raster graphics as with other printers.

- Pen plotters can draw complex line art, including text, but do so slowly because of the mechanical movement of the pens. They are often incapable of efficiently creating a solid region of colour, but can draw an area by drawing a number of close, regular lines.

- Plotters offered the fastest way to efficiently produce very large drawings or colour high-resolution vector-based artwork when computer memory was very expensive and processor power was very limited.

Plotters : Types

- A **drum plotter** draws on paper wrapped around a drum which turns to produce one direction of the plot, while the pens move to provide the other direction.

- ·A **flatbed plotter** draws on paper placed on a flat surface; and an electrostatic plotter draws on negatively charged paper with positively charged toner.

- Pen plotters have essentially become obsolete, and have been replaced by large-format inkjet printers and toner based printers.

- They are most frequently used for CAE (computer-aided engineering) applications, such as CAD (computer-aided design) and CAM (computer-aided manufacturing).

Summery

- The DVST, Flat- panel display are the integral part of the CAD system
- Hard copy devices - Printers and Plotters, dot matrix, inkjet, laser printers are the output devices

Questions

- Explain the DVST.

- Present the Display devices - Flat- panel display

- Explain the Hard copy devices - Printers and Plotters, dot matrix, inkjet, laser printers and present the comparative study among them

Text books

- Electronic Display Devices by Shoichi Matsumoto – 1990

- Display Devices and Systems by the University of Michigan

- Comparison of Three Display Devices for Unattended Ground by Harold Martinek, Richard E. Hilligoss, Felix Lavicka - 1978

- thank you