

EC-301 Computer Graphics

Lecture Slides- Wk3&4:

- Overview of Graphics Systems

Overview of Graphics Systems

- **Video Display Devices**

refresh cathode-ray tubes; raster-scan displays; random scan displays; color CRT monitors; flat-panel displays; 3D viewing devices; stereoscopic & virtual-reality systems

- **Raster Scan Systems**

video controller; raster-scan display processor (aka graphics controller)

□ Video Display Devices

Refresh Cathode-Ray Tubes:

- Video monitors, primary output devices, are based on CRT design or solid-state technologies
- Spots of light produced on phosphor-coated screen by directing electron beams
- CRT vs. refresh CRT
- Magnetic Deflection CRTs vs. Electrostatic Deflection CRTs
- Phosphor colors and *persistence*, CRT's *resolution* and *high-definition* systems

Cathode-Ray Tube

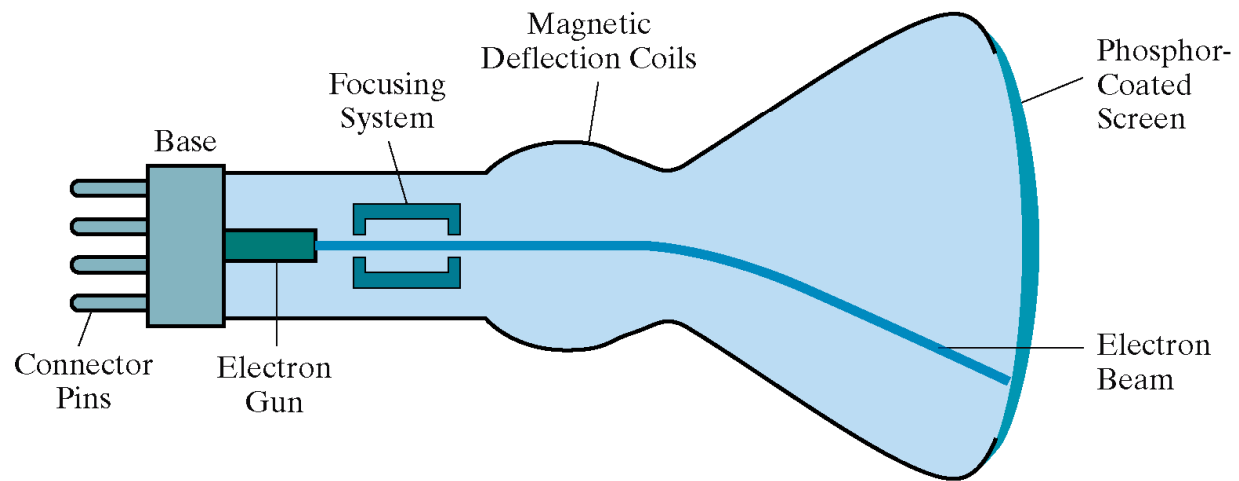
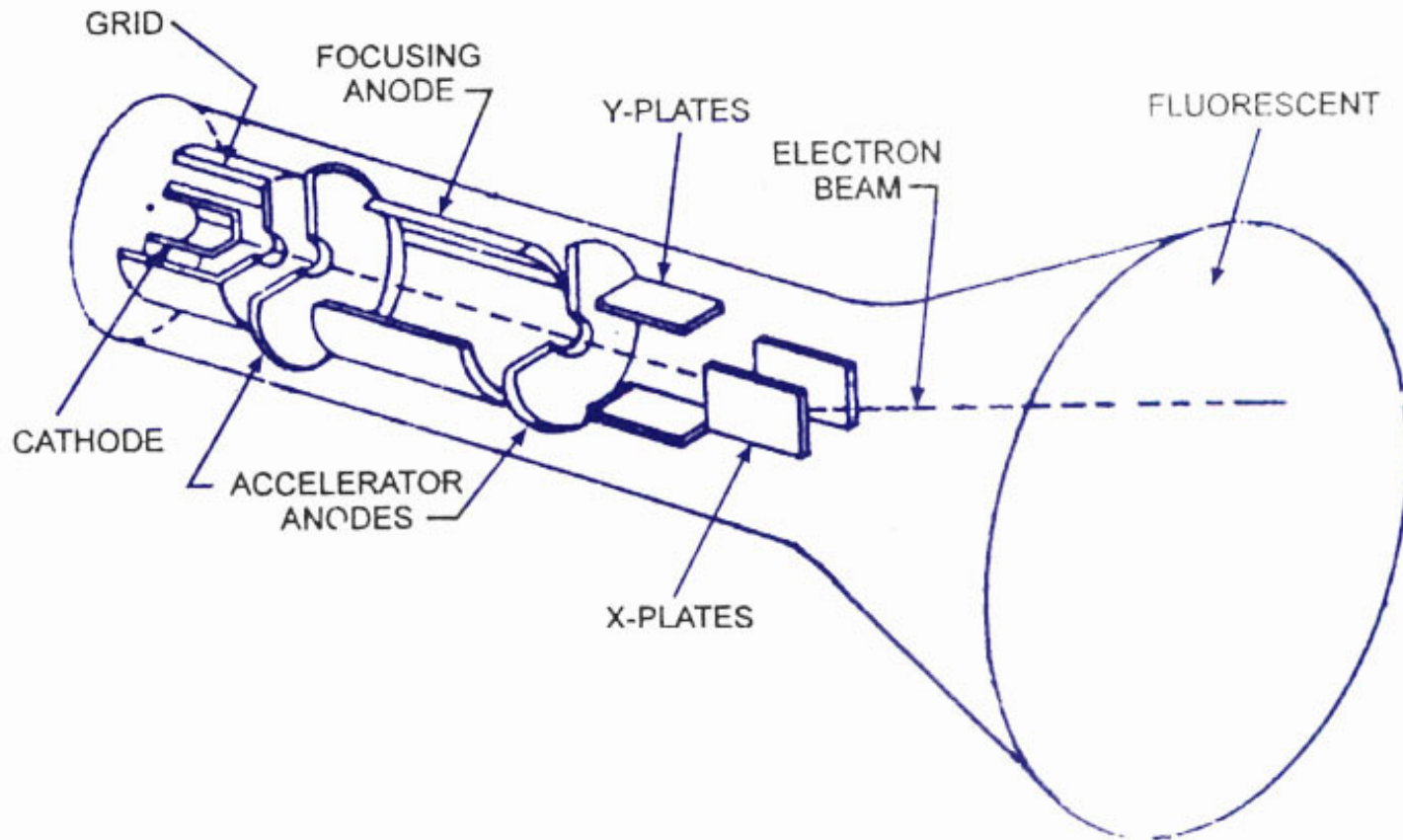


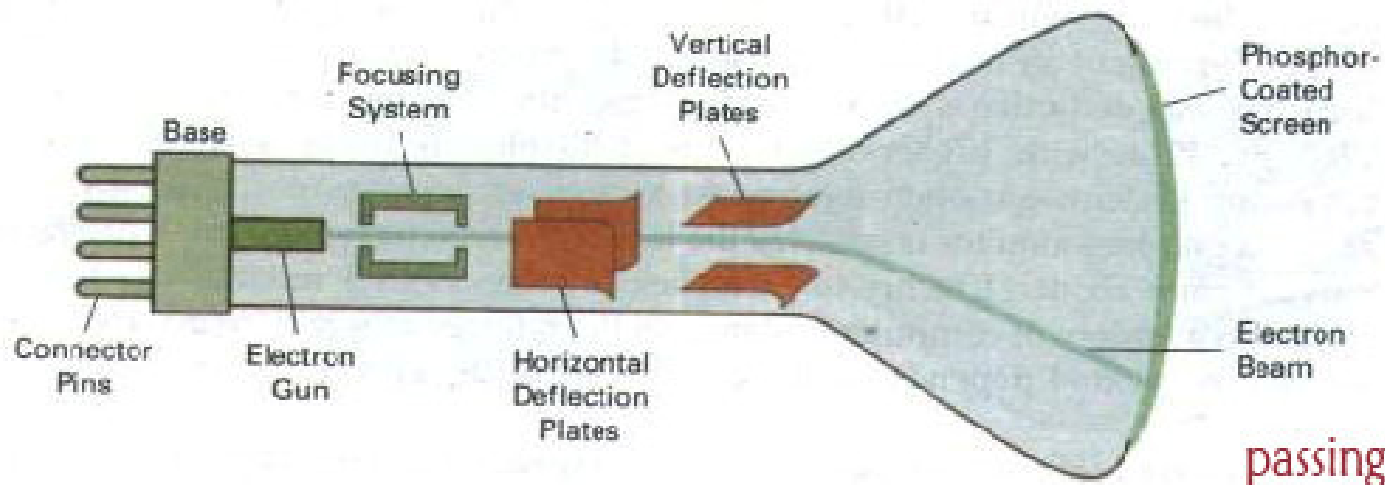
Figure 2-2
Basic design of a magnetic-deflection CRT.
(H&B Book, 3rd Ed)

Cathode-Ray Tube



Cathode Ray Tube
(www.circuitstoday.com)

Cathode-Ray Tube



passingmarks.net

Electrostatic deflection of the electron beam in a CRT

Raster-Scan Displays:

- Most common type of graphics monitor employing a CRT, based on television technology
- Electron beam is swept across the screen, one row at a time, from top to bottom (*scan lines*)
- Picture definition stored in memory called *refresh buffer* or *frame buffer* (aka *color buffer*)
- *Pixel* or *pel*, *aspect ratio*, *bitmap*, *pixmap*, *horizontal / vertical retrace*, *interlaced* refresh
- Home television sets, and printers use raster-scan methods

Raster Scan Display

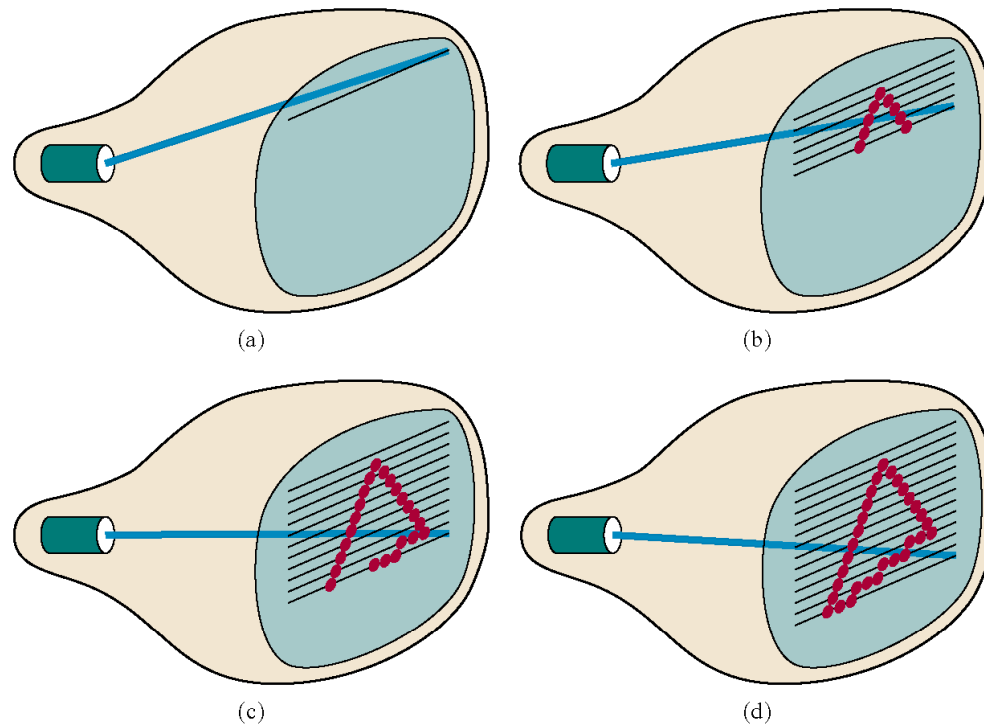


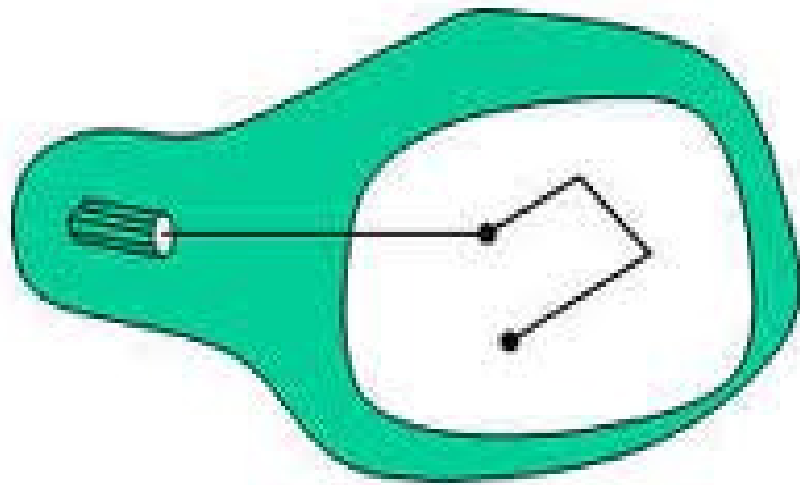
Figure 2-7

A raster-scan system displays an object as a set of discrete points across each scan line.

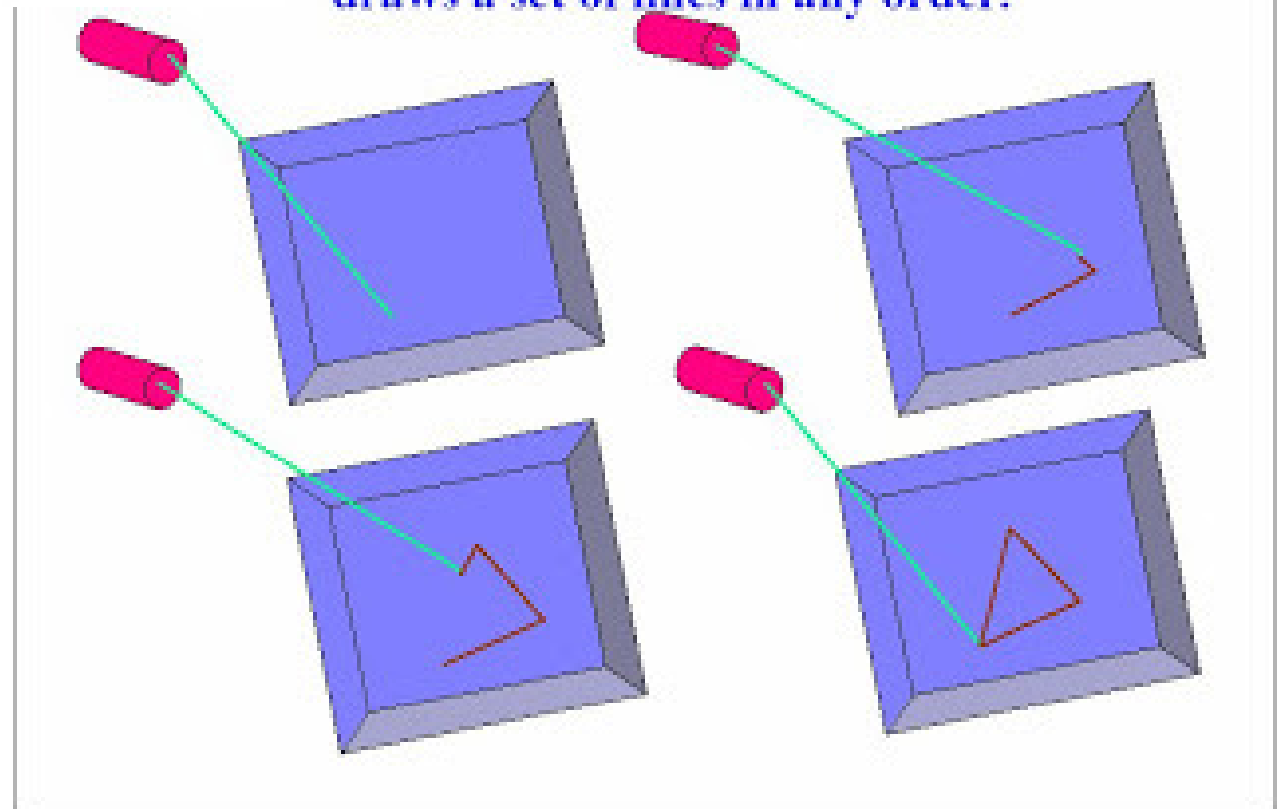
(H&B Book, 3rd Ed)

Random-Scan Displays:

- Electron beam directed to selected parts of the screen (where a picture is to be displayed)
- Pictures are generated as line drawings, monitors called *vector displays*
- *Display list*: Set of line drawing commands
- Designed for architectural & Engg layouts
- Have higher resolution than raster-scan systems
- Raster systems are preferred because of their greater flexibility and improved line-drawing capabilities

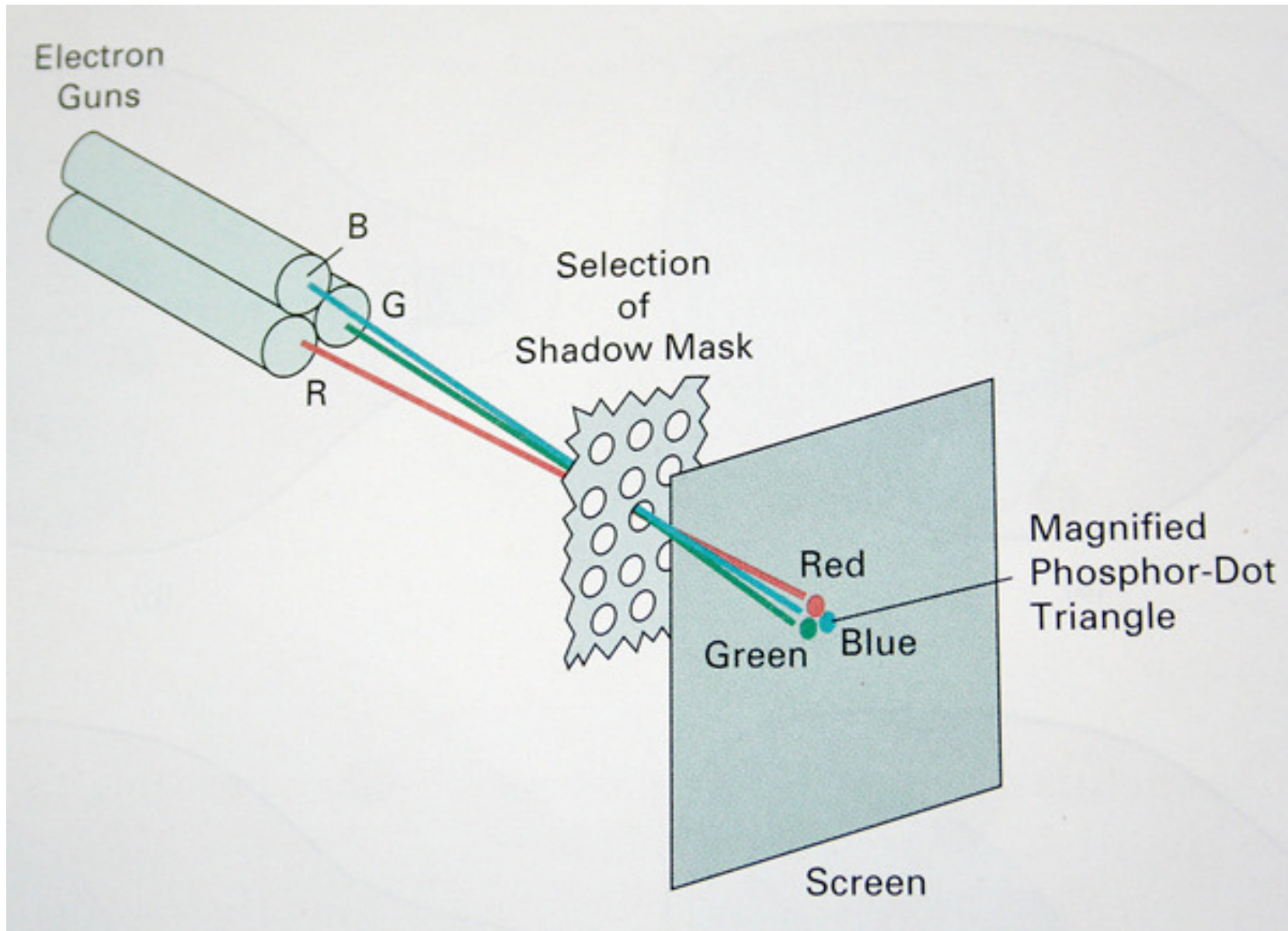


**Random-scan display system
draws a set of lines in any order.**



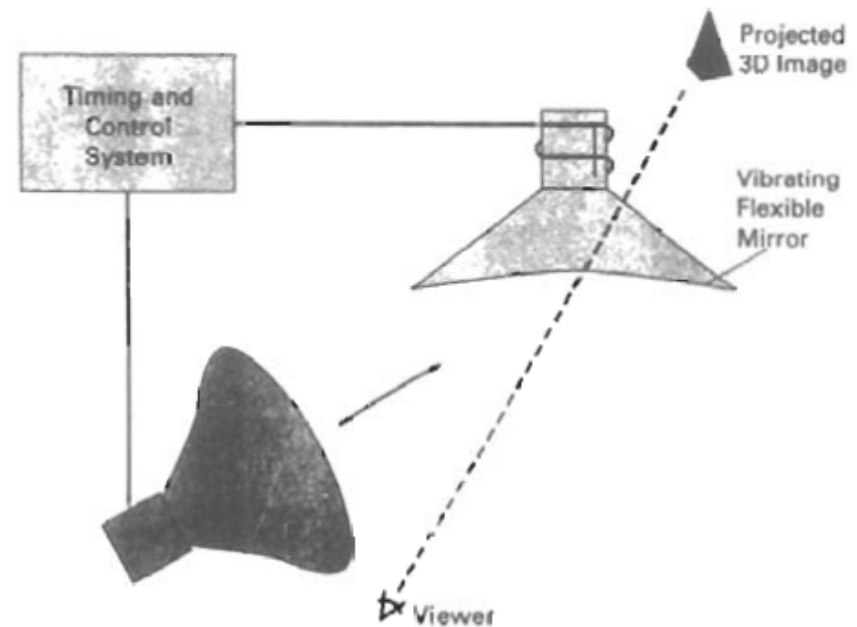
Color CRT Monitors:

- Use combination of phosphors that emit different-colored light
- *Beam-penetration*: two phosphor layers red & green, color depends on speed of electron, limited no. of colors possible
- *Shadow-mask*: 3 phosphor dots at each pixel position, 3 electron guns, delta-delta shadow mask
- *In-line* arrangement: electron guns and color dots aligned along the scan line
- High-quality raster graphics system uses 24 bits per pixel



Three-Dimensional Viewing Devices:

- For the display of 3D scenes
- Reflects a CRT image from a vibrating, flexible mirror
- Allows to walk around an object or scene and view it from different sides



Stereoscopic and Virtual-Reality Systems:

- Not true 3D images, but provides a 3D effect
- Uses two views of a scene along the lines of right and left eye
- Gives perception of a scene depth when right view is seen from right eye and left scene is seen from left eye (stereoscopic effect)
- Display each view at alternate refresh cycles.
- It is a component in virtual-reality systems, where user can step into a scene and interact with the environment (use of a headset)



Overview of Graphics Systems (Cont.)

- **Graphics Workstations & Viewing Systems**

general-purpose computer systems to multi-monitor facilities, high-definition graphics systems used in medical imaging, air-traffic control, simulation and CAD

- **Input Devices**

keyboards, button boxes, and dials; mouse devices; trackballs and spaceballs; joysticks; data gloves; digitizers; image scanners; touch panels; light pens; voice systems



Overview of Graphics Systems (Cont.)

- **Hard-Copy Devices**

plotters and printers, quality depends on dot size and number of dots per inch

- Plotters

- 2D moving pen with stationary paper
- 1D pen and 1D moving paper

- Printers

- Impact devices
 - Inked ribbon
- Non impact devices
 - Laser, ink-jet, etc

Overview of Graphics Systems (Cont.)

- **Graphics Networks**

resources (processors, printers, plotters and data files) distributed on a network and shared by multiple users, server & client

Overview of Graphics Systems (Cont.)

- **Graphics on the Internet**

computers communicate using TCP/IP, www provides hypertext system, uniform resource locator (url), http, ftp sites, hypertext markup language (HTML), web browsers, search engines

Overview of Graphics Systems (Cont.)

- **Graphics Software**

- Special purpose
 - For non programmers
 - CAD, painting, animation
- General programming packages
 - C, C++, Java, ...
 - Library of graphics functions (OpenGL)
 - Picture components (lines, shapes, ...)
 - Transformations (color, texture, shading, rotating, ...)