Computer Graphics

- anything which is not a text.
- art of drawing pictures, lines, charts...
- made up of no. of pixel
- pixel : smallest graphical unit.

Types of CG

interactive	- non interactive
- 2 way communication possible	- One way communication possible
- user have control over system	- user don't have control over system
- Adv :) higher quality	
2) Precise result	Aspect Ration = $\frac{Width \; Unit}{Height \; Unit}$
3) Greater Productivity	
4) lower analysis	
5) low design cost	

Applications of CG

1) Display of infor.
2) Design
3) User Interface
4) Simulation

- CAD
- Presentation Graphics
- Computer Art
- Entertainment
- Education & Training
- Visualization
- Image Processing
- GUI

Elements of pictures

Computer screen → finite, finite no. of pixel

Pixel → basic element of picture
→ smallest addressable screen element

Coordinates System
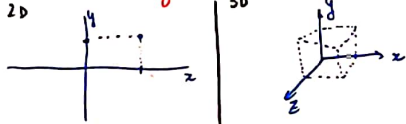
Video Adapters

- Integrated Circuit Card provides D/A converter, Video RAM, video controller

Types of display adapters

- Resolution
- Color Depth
- Refresh Rate
- Acceleration

Modes of Resolution

- Text mode / Character mode
- graphics mode

Display mode → Resolution

VGA	→ 640 × 480
SVGA	→ 800 × 600
XGA	→ 1024 × 768
SXGA	→ 1280 × 1014
UXGA	→ 1600 × 1200

Rotating Memory Frame Buffer

- situation when we use screen resolution less than max resolution

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Graphics Display devices

Interactive devices	Data Generating devices
- joystick	- scanner → flat, hand, Sheet fed
- trackball	- digitizer
- mouse	
- lightpen	
- touch panel	
- tablets	

Display Devices

1) Video Display devices
   → monochrome display monitors
   → color display monitors
2) Raster Graphics Display
3) Plotters
4) Direct View Storage Tubes
5) Plasma panel
6) Vector Refresh Display

LED & LCD

LED	LCD
- less power consumption	- more power consumption
- Response Rate Time faster	- slower RRT
- less color accuracy	- more color accuracy
- cannot be xtremly slim	- can be xtremly slim

Cathode Ray Tube

- used in computer, monitors & TV
- image on CRT display → created by firing electron from back of tube of phosphorus located towards front of screen
- electron heats phosphorus → light up → projected on screen
- color seen on the screen produced by a mix of Red, Blue, Green light

Components of CRT

- Electron gun
- Control Electrode
- Focusing system
- Deflection Yoke
- Phosphorus Coated Screen
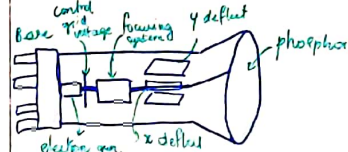
Random & Raster Scan display

Raster Scan

- poor or less resolution because picture definition is stored as intensity value
- less expensive than RMS.
- uses pixels along scan line for drawing an image
- zigzag line produced because plotted value are discrete.
- stores picture definition in refresh buffer → frame buffer
- RR = 60 to 80 fps

Random Scan

- higher resolution because it stores picture definition as set of line cmds
- costlier than RRS
- uses mathematical function to draw
- smooth line is produced because directly line path is followed by electron beam
- stores picture definition as a set of line cmd → refresh display file
- RR = 30 to 60 fps

Open GL

- open graphics library
- low level graphics API

Open GL operations

- display list
- evaluator
- primitive assembly
- rasterization
- pre fragment opⁿ

OpenGL features

- display lists
- feedback
- alphabending
- pixel opⁿ
- texture mapping
- color index mode
- polynomial evaluators

Open GL basic primitives

GL_POINTS → renders pt
GL_LINES → draw unconnected line segments
GL_LINE_STRIP → sequence of connected line segments
GL_LINE_LOOP → closes line strip
GL_TRIANGLE → draw triangle
GL_TRIANGLE_STRIP → sequence of △ that share edges
GL_TRIANGLE_FAN → share edges as well as vertices
GL_QUADS → draw a separate convex quadrilateral
GL_QUADS_STRIP → sequence of quadrilaterals
GL_POLYGONS → draw polygons

OpenGL interactions

- mouse event
- Keyboard event