

School of Mechanical Engineering

Course Code : BAUT4001

Course Name: CAD/CAM

The logo of Galgotias University is a stylized 'G' composed of three curved, overlapping bands in shades of red, yellow, and blue. The text 'Unit - 1' is underlined and 'Computer Graphics' is in a larger font, both in red, centered over the logo.

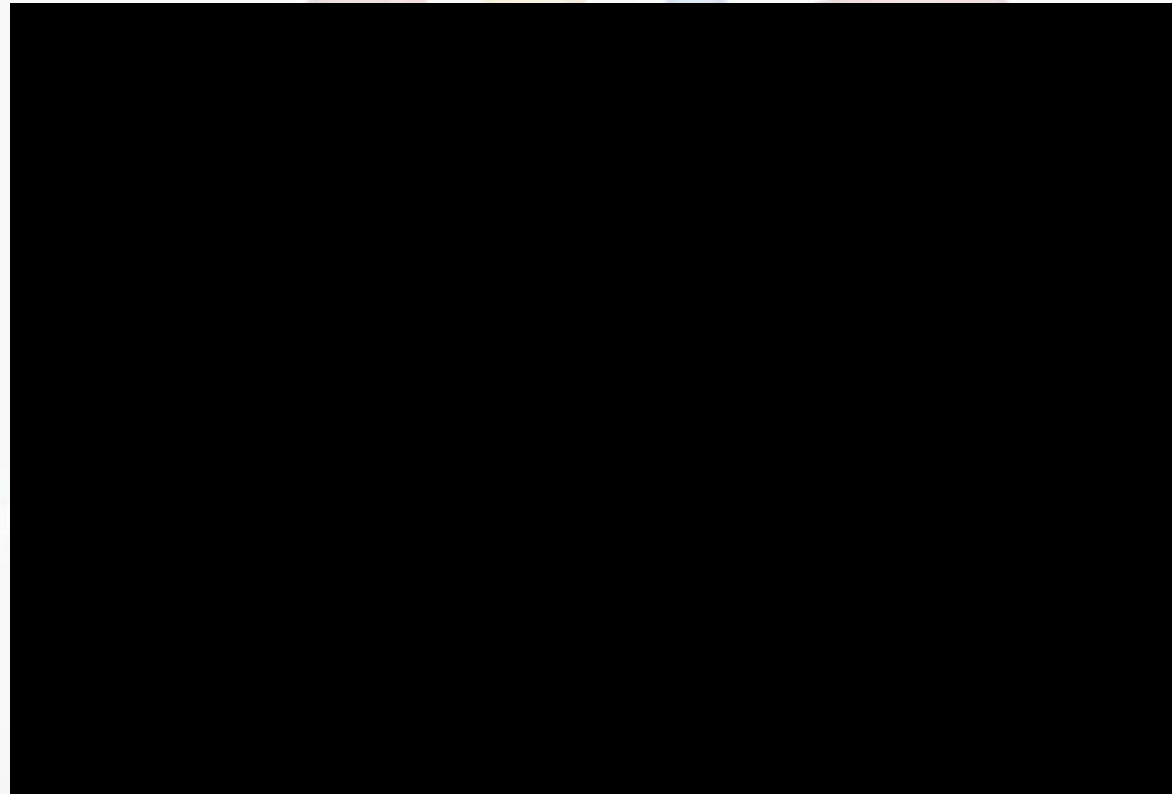
Unit – 1 Computer Graphics

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Program Name: B.Tech¹ (Auto)

What is Computer Graphics?



Objectives

- In this lecture, we explore what computer graphics is about and survey some application areas
- We start with a historical introduction

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Computer Graphics

- *Computer graphics* deals with all aspects of creating images with a computer
 - Hardware
 - Software
 - Applications

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Example

- Where did this image come from?

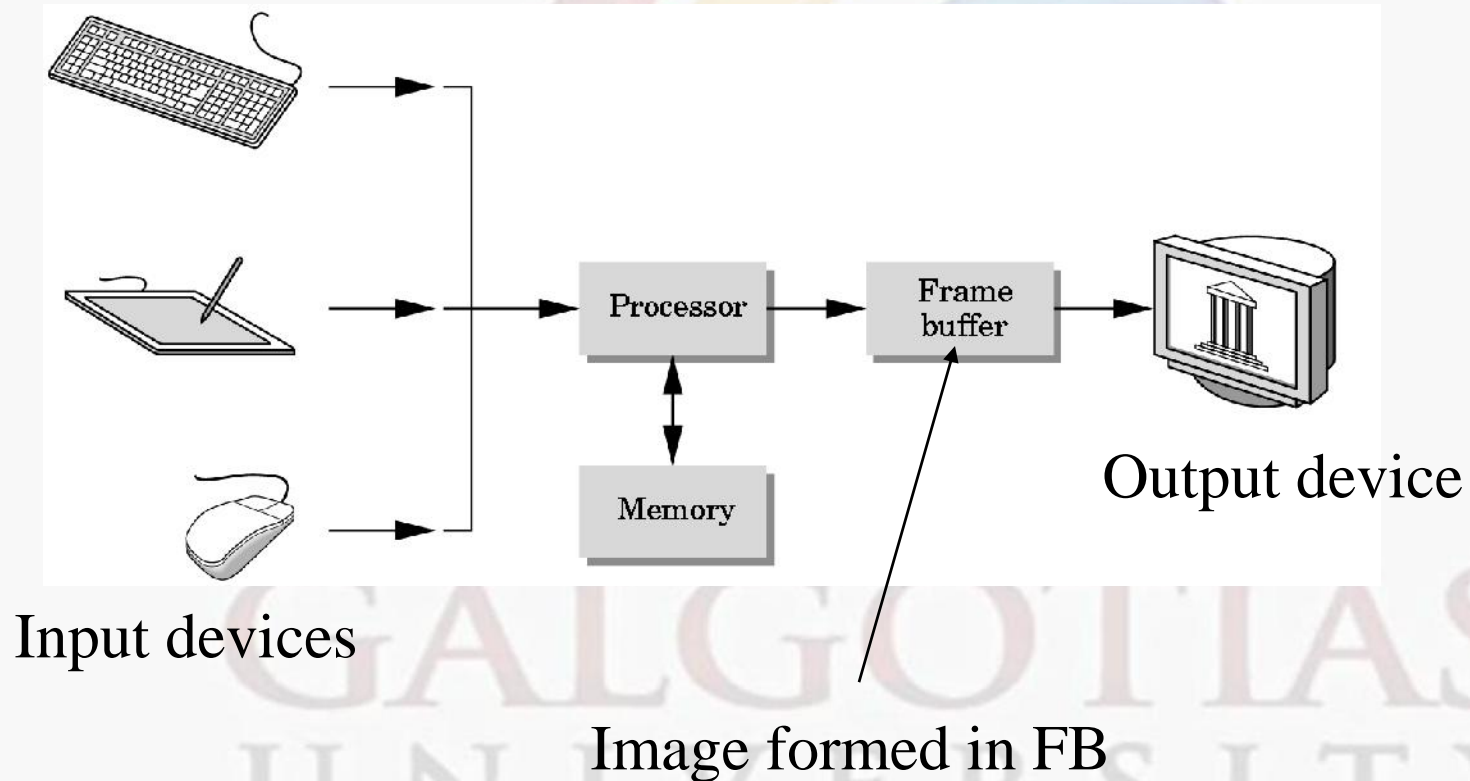


- What hardware/software did we need to produce it?

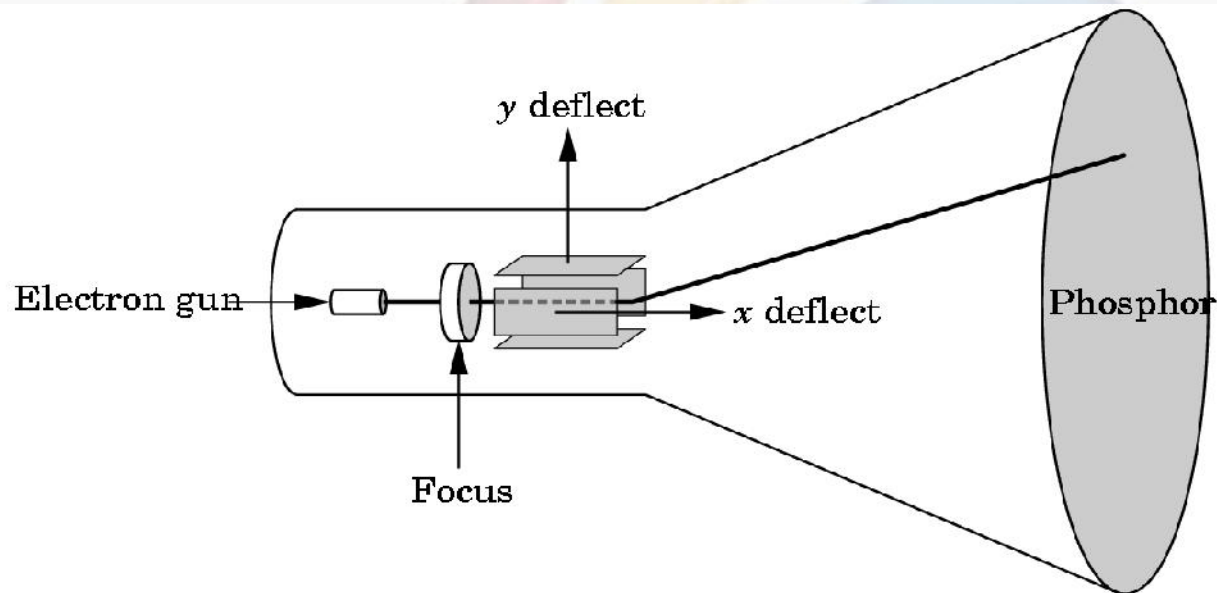
Preliminary Answer

- **Application:** The object is an artist's rendition of the sun for an animation to be shown in a domed environment (planetarium)
- **Software:** Maya for modeling and rendering but Maya is built on top of OpenGL
- **Hardware:** PC with graphics card for modeling and rendering

Basic Graphics System



CRT



Can be used either as a line-drawing device (calligraphic) or to display contents of frame buffer (raster mode)

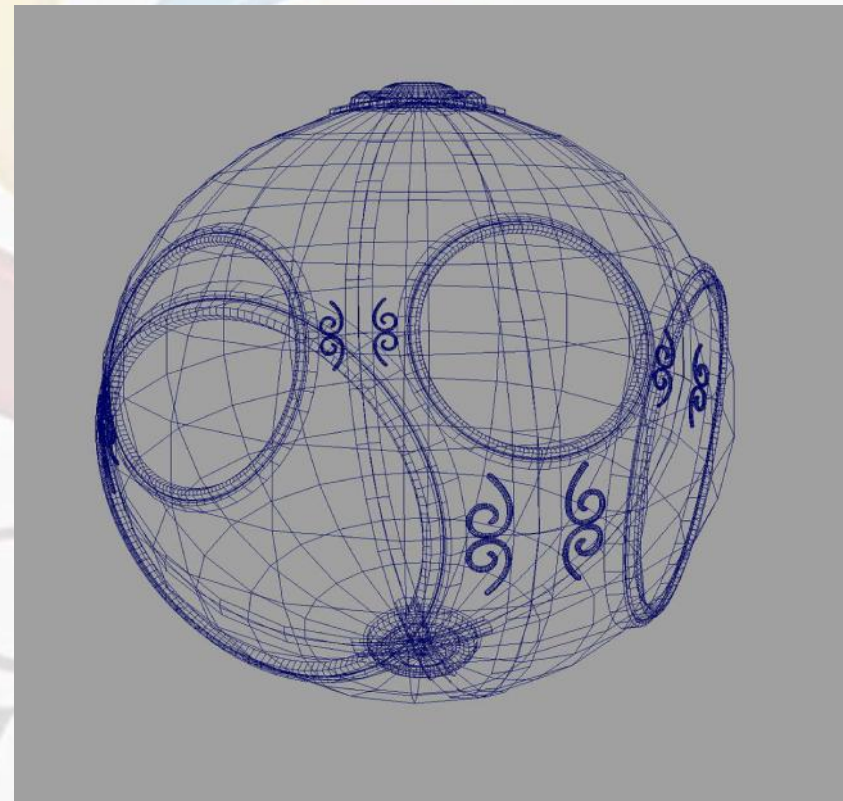
Computer Graphics: 1950-1960

- Computer graphics goes back to the earliest days of computing
 - Strip charts
 - Pen plotters
 - Simple displays using A/D converters to go from computer to calligraphic CRT
- Cost of refresh for CRT too high
 - Computers slow, expensive, unreliable

Computer Graphics: 1960-1970

- *Wireframe* graphics
 - Draw only lines
- Sketchpad
- Display Processors
- Storage tube

wireframe representation
of sun object

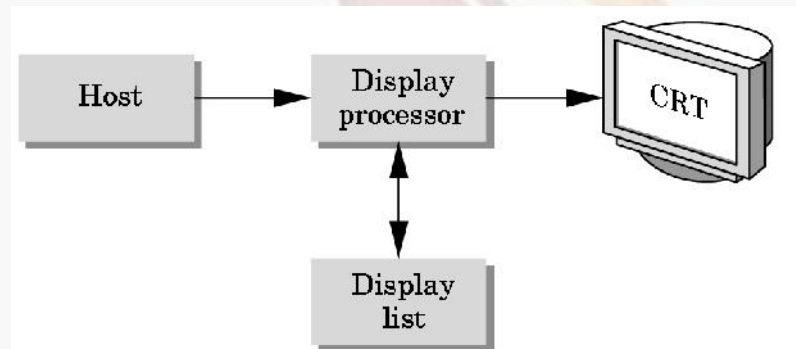


Sketchpad

- Ivan Sutherland's PhD thesis at MIT
 - Recognized the potential of man-machine interaction
 - Loop
 - Display something
 - User moves light pen
 - Computer generates new display
 - Sutherland also created many of the now common algorithms for computer graphics

Display Processor

- Rather than have the host computer try to refresh display use a special purpose computer called a *display processor* (DPU)



- Graphics stored in display list (display file) on display processor
- Host *compiles* display list and sends to DPU

Direct View Storage Tube

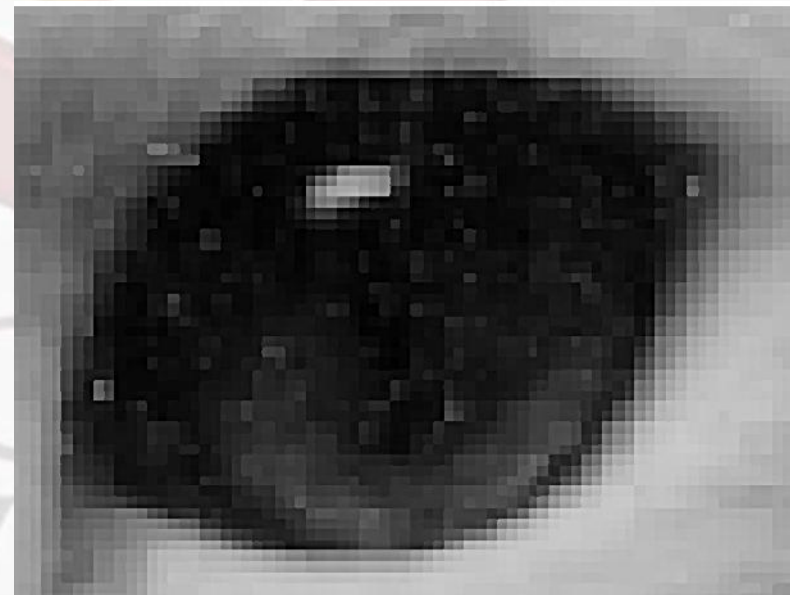
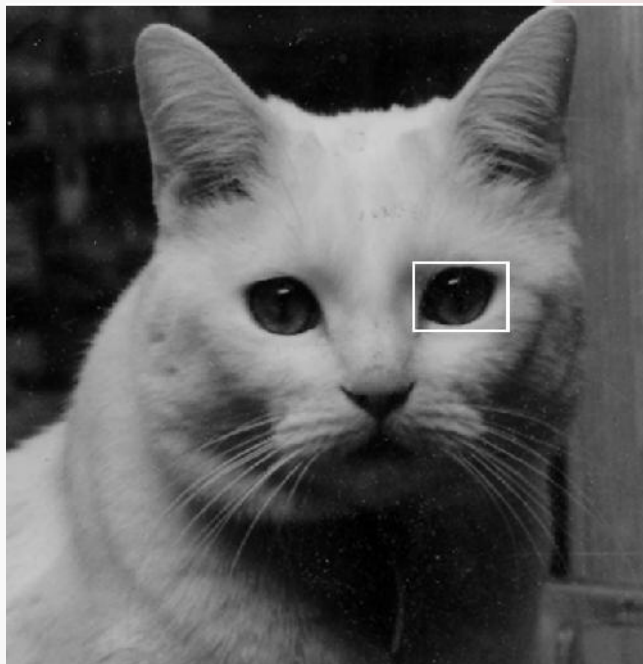
- Created by Tektronix
 - Did not require constant refresh
 - Standard interface to computers
 - Allowed for standard software
 - Plot3D in Fortran
 - Relatively inexpensive
 - Opened door to use of computer graphics for CAD community

Computer Graphics: 1970-1980

- Raster Graphics
- Beginning of graphics standards
 - IFIPS
 - GKS: European effort
 - Becomes ISO 2D standard
 - Core: North American effort
 - 3D but fails to become ISO standard
- Workstations and PCs

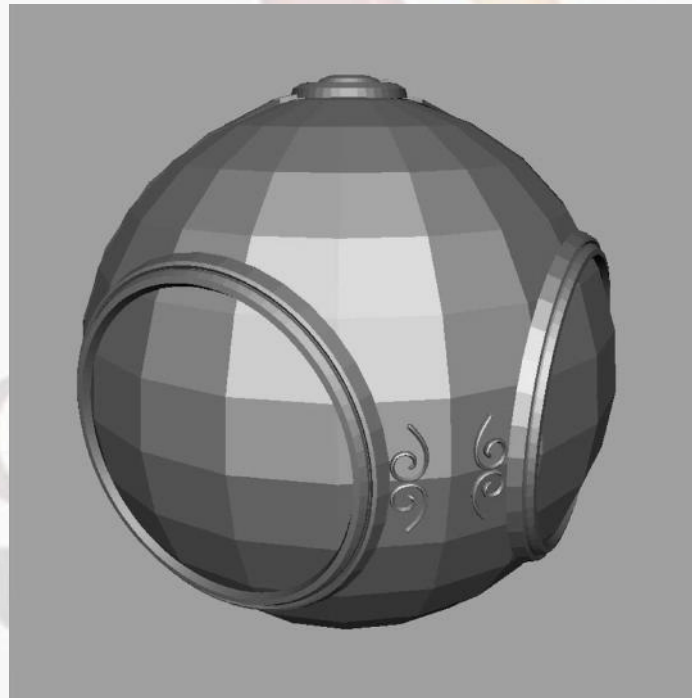
Raster Graphics

- Image produced as an array (the *raster*) of picture elements (*pixels*) in the *frame*



Raster Graphics

- Allows us to go from lines and wire frame images to filled polygons

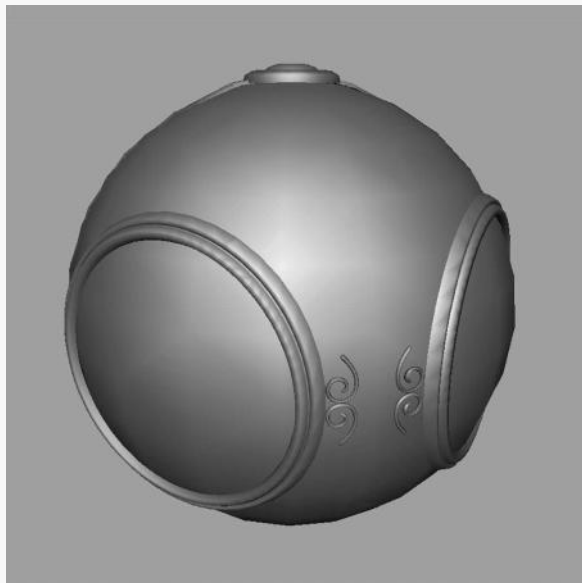


PCs and Workstations

- Although we no longer make the distinction between workstations and PCs, historically they evolved from different roots
 - Early workstations characterized by
 - Networked connection: client-server model
 - High-level of interactivity
 - Early PCs included frame buffer as part of user memory
 - Easy to change contents and create images

Computer Graphics: 1980-1990

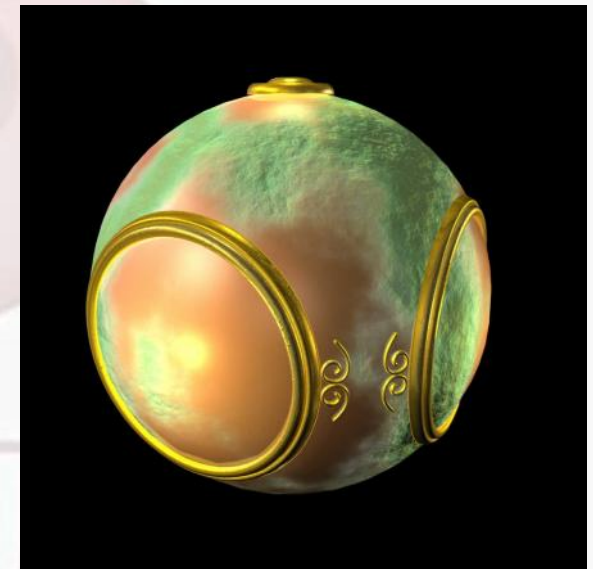
Realism comes to computer graphics



smooth shading



environment
mapping



bump mapping

Computer Graphics: 1980-1990

- Special purpose hardware
 - Silicon Graphics geometry engine
 - VLSI implementation of graphics pipeline
- Industry-based standards
 - PHIGS
 - RenderMan
- Networked graphics: X Window System
- Human-Computer Interface (HCI)

Computer Graphics: 1990-2000

- OpenGL API
- Completely computer-generated feature-length movies (Toy Story) are successful
- New hardware capabilities
 - Texture mapping
 - Blending
 - Accumulation, stencil buffers

Computer Graphics: 2000-2010

- Photorealism
- Graphics cards (GPU) for PCs dominate market
 - Nvidia, ATI
- Game boxes and game players determine direction of market (Wii, Kinect, etc)
- Computer graphics routine in movie industry: Maya, Lightwave
- Programmable pipelines

Computer Graphics: 2010-

- Mobile Computing
 - iPhone
- Cloud Computing
 - Amazon Web Services (AWS)
- Virtual Reality
 - Oculus Rift
- Artificial Intelligence
 - Big Data/Deep Learning
 - Google Car