

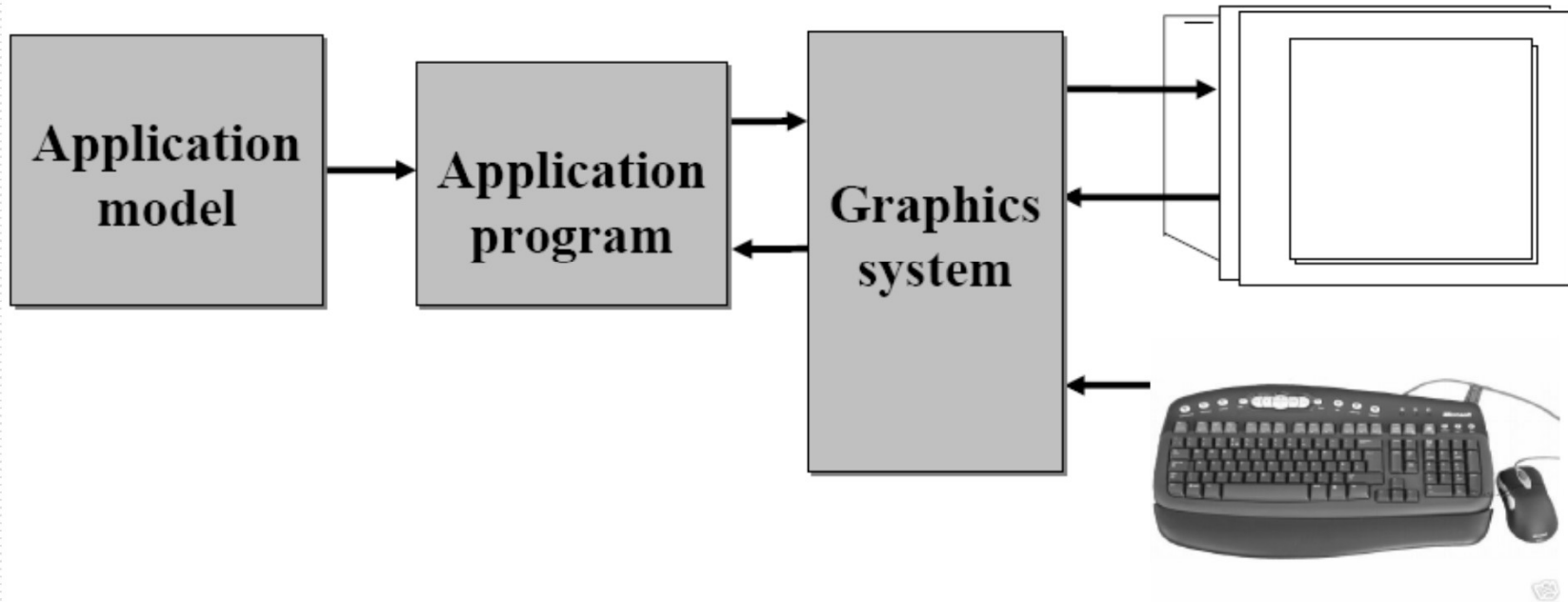
COMPUTER GRAPHICS

Section – I INTRODUCTION

COMPUTER GRAPHICS

- ❑ *Computer Graphics is subfield of computer science which involves **display, manipulation and storage** of pictures, experimental data and geometric information for **proper visualization** using computational techniques.*
 - ❑ Typical **graphics system** comprises of a host computer with support of **fast processor, large memory, frame buffer** and
 - **Display devices** (color monitors),
 - **Input devices** (mouse, keyboard, joystick, touch screen, trackball)
 - **Output devices** (LCD panels, laser printers, color printers. Plotters etc.)
 - **Interfacing devices** such as, video I/O, TV interface etc.
 - ❑ Computer graphics used in diverse areas such as science, engineering, medicine ,business, industry, government, art, entertainment , advertising education and training.
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Conceptual framework for interactive graphics



Graphics Applications

☐ **Typical applications areas are**

- Entertainment
 - Computer-aided design
 - Scientific visualization
 - Training & Education
 - Computer art
 - Image Processing
 - GUI
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Entertainment

- Animations are frequently used in advertising and television commercials.
- Frame by frame motion is used.
- Commonly used computer graphics method is Morphing
 - Object is transferred into another object
 - Eg: An automobile into a tiger.
- Computer Graphics methods are commonly used in making motion pictures, music videos and television shows
- Graphics objects can be combined with live action, actors and live scenes.



Jurassic Park
(Industrial Light & Magic)



Quake
(3D Software)

Computer-aided design

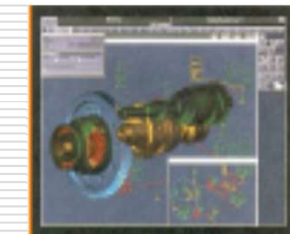
- Computer Aided Design (CAD) used in design of **buildings , automobiles, aircraft, watercraft textiles** etc.
- Wireframe models are used.(outline forms)
 - Show overall shape and internal features of objects.
 - Helps to watch the behavior of inner components during motion.
 - Useful for testing the performance of the system or vehicles.
- Animations in Virtual Reality Environment (VR).
 - Determines how vehicle operators affected by certain motions.
 - Helps designer to explore various positions that obstruct operators view.



Los Angeles Airport
(Bill Japon, UCLA)



Boeing 777 Airplane
(Boeing Corporation)



Gear Shaft Design
(Integratex Corporation)

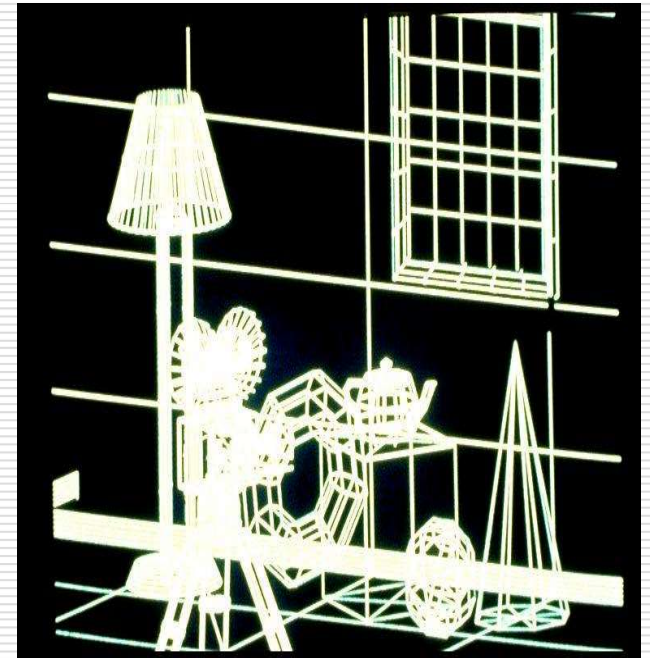
Computer-aided design

Network Communications:

- Designed by placing components into the layout using graphics packages by providing connections.

Architectural Designs

- Architects use interactive graphics to lay floor plans, Positioning of rooms, doors, windows, stairs and other buliding features.
- Electrical Enginer can try out arrangements for wiring , electrical layouts and fire warning systems
- Realistic displays of architectural designs done.



Wireframe models

Scientific visualization

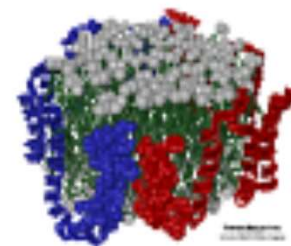
- Scientists, engineers, medical personnel analysts
 - Satellite cameras producing large data files can be interpreted and converted in the visual form
- Producing **graphical representation** for scientific engineering and medical datasets and processes is generally referred as **scientific visualization**.

Display of complex structures, complex molecular structures such as proteins and DNA, weather forecasting, complex mathematical objects.
- Techniques such as contour plots, graphs and charts, surface renderings



Airflow Inside a Thunderstorm
(Bob Wilhelmson,
University of Illinois at Urbana-Champaign)

University of Illinois at Urbana-Champaign



Apo A-1
(Theoretical Biophysics Group,
University of Illinois at Urbana-Champaign)



Visible Human
(National Library of Medicine)

Education & Training

- ❑ Computer generated models are used as educational aids.
- ❑ Specialized systems like simulators for training of ship captains, aircraft pilots, heavy –equipment operators are used.
- ❑ Output of Automobile simulator is used to investigate the behavior of drivers in critical situations and optimizing the vehicle design.



Driving Simulation
(Source: B. Sathyanand)



Flight Simulation
(Source: B. Sathyanand)



Desk Assembly
(Source: B. Sathyanand, Dec. 2)

Computer art

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- ❑ Variety of computer methods including special purpose hardware , specially developed software like mathematics packages(mathematica),CAD packages , desktop publishing packages and animation packages provide facilities for designing object shapes and motions.
 - ❑ CG methods are also applied in commercial art for logos and other designs.
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Image Processing

- ❑ Image processing (IP) applies techniques to modify or interpret existing pictures.
 - Improves image quality
 - machine perception of visual information.
- ❑ Methods like **retouching and rearranging of sections of photographs** used to analyze satellite photos of earth and galaxies.
- ❑ IP and CG are combined in many medical applications
 - to design artificial limbs
 - to model and study physical functions,
 - Computer aided surgery.



Image Composition
(Michael Beutels, CS-226, Fall99)



Image Morphing
(All students in CS 424, Fall99)

Graphical User Interface(GUI)

- ❑ Software packages provide graphics interface.
 - ❑ Window manger allows a user to display multiple-window areas.
 - ❑ Each window contain different graphical or nongraphical displays.
 - ❑ **Typical Components Used:**
 - **Menus ,Icons , Cursors , Dialog Boxes, Scroll Bars ,Buttons**
 - **Valuators ,Grids, Sketching , 3-D Interface**
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Graphics packages and Platforms

- ❑ Various application packages and standards are available:
 - Core graphics
 - **GKS** Graphics Kernel System by ISO (International Standards Organization) & ANSI (American National Standards Institute)
 - **SRGP** Simple Raster Graphics Package
 - **PHIGS** Programmers Hierarchical Interactive Graphics System
 - **OpenGL** (with ActiveX and Direct3D)
 - ❑ On various platforms, such as
 - DOS, Windows,
 - Linux, OS/2,
 - SGI, SunOS,
 - Solaris, HP-UX,
 - Mac, DEC-OSF.
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☐ Thank you
