
CIS 454 Computer Graphics

Lecture 1, 09/05/2006

Li Shen

Computer and Information Science

UMass Dartmouth

Notes

- Handouts
 - Syllabus
 - Schedule
 - Project/Presentation
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Basic Information

- Li Shen
 - Dion 307A
 - (508) 910-6691
 - lshen@umassd.edu
 - Lectures:
 - Tue and Thu, 9:30-10:45am, Dion 105
 - Office Hours:
 - Tue 11am-12:30pm
 - Thu 11am-12:30pm
 - Fri 12-1pm
 - by appointment
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Course Description and Objectives

- Description
 - Graphics devices. Two dimensional and three dimensional image representations and transformations. Graphics systems software architecture; graphics standards; packages.
 - Objectives
 - To study basic mathematical backgrounds related to computer graphics including linear algebra and geometry.
 - To study fundamental computer graphics topics including graphics pipeline architecture, transformations, modeling, viewing, shading, and texture mapping.
 - To study OpenGL programming and learn both theoretical and practical aspects of computer graphics.
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Course Materials

- **Textbooks**
 - **Interactive Computer Graphics: A Top-Down Approach Using OpenGL, Fourth Edition.** Edward Angel. Pearson Education, 2005, ISBN 0321321375. (Primary textbook)
http://www.cs.unm.edu/~angel/BOOK/INTERACTIVE_COMPUTER_GRAPHICS/FOURTH_EDITION/.
 - **OpenGL(R) Programming Guide: The Official Guide to Learning OpenGL, Version 2 (5th Edition).** OpenGL Architecture Review Board, Dave Shreiner, Jackie Neider, Mason Woo, Tom Davis. Addison-Wesley, ISBN 0321335732. (Supplementary textbook)
http://www.opengl.org/documentation/red_book/.
 - **Important Web Links**
 - Course Homepage:
http://www.cis.umassd.edu/~lshen/courses/200607_fall_cis454/index.htm
 - Textbook Homepage:
http://www.cs.unm.edu/~angel/BOOK/INTERACTIVE_COMPUTER_GRAPHICS/FOURTH_EDITION/
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Recommended References

- **The OpenGL Reference Manual** (<http://www.rush3d.com/reference/opengl-bluebook-1.0/>): The Official Reference Document to OpenGL.
 - **OpenGL tutorial programs** (<http://www.xmission.com/%7Enate/tutors.html>): Nate Robins' tutorial programs on basic graphics functionality in OpenGL. ([Demo](#))
 - **SIGGRAPH proceedings**, published annually as special editions of the journal ACM SIGGRAPH Computer Graphics.
 - **SIGGRAPH Video Review** (<http://www.siggraph.org/publications/video-review/SVR.html>): some are available for viewing at Instructional Technology (<http://www.cmu.edu/computing/instructional-tech/>).
 - **3D Computer Graphics (3rd Edition)**, Alan H. Watt Addison-Wesley, ISBN 0201398559.
 - **Computer Graphics: Principles and Practice, 2nd edition** C. Foley, van Dam, Feiner, and Hughes. Addison-Wesley, 1996. This book covers a lot of ground and is a good reference book on computer graphics.
 - **Fundamentals of Computer Graphics, Second Edition.** Peter Shirley et al. A.K.Peters, 2005, ISBN 1568812698. (Primary textbook) <http://www.cs.utah.edu/~shirley/fcg2/>.
 - **Introduction to Matlab:** <http://www.cs.dartmouth.edu/~farid/tutorials/matlab.intro.html>
 - **Matlab online documentation:** <http://www.mathworks.com/access/helpdesk/help/helpdesk.html>
 - **Matlab Primer:** <http://ise.stanford.edu/Matlab/matlab-primer.pdf>
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Requirements and Grading

- Homework: 25%
 - Presentation: 10%
 - Term project: 15%
 - Midterm exam: 20%
 - Final exam: 25%
 - Class participation: 5%
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Important Dates

- 10/26/06 (in class): Midterm exam
 - 11/21/06: Project and presentation topic proposal due
 - 12/14/06: Project due
 - 12/18/06 (11:30am-2:30pm Monday): Final exam
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Assignments

- Learning portal:
<http://web.cis.umassd.edu/portal/index.html>
 - Email me your portal ID
 - Due at the beginning of class
 - Late homework not accepted; exception needs approval
 - Your submitted homework must be entirely your own
 - though discussion is encouraged.
 - Four programming assignments
 - Assignments 1-3 may also have written questions that test understanding of mathematical and geometrical concepts taught
 - Assignment 4 is your term project, including code documentation and project report.
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Academic Honesty

- UMass Dartmouth Academic Ethical Standards
 - Student Handbook
(<http://www.umassd.edu/studenthandbook/>)
 - All work submitted for credit must be your own.
 - Written work, programs, exams
 - Questions? Please speak to me.
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Introduction

Computer graphics is concerned with all aspects of producing pictures or images using a computer ([demo](#))

Objectives

- Broad introduction to Computer Graphics
 - Software
 - Hardware
 - Applications
 - Top-down approach
 - OpenGL
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Prerequisites

- Good programming skills in C (or C++)
 - Basic Data Structures
 - Linked lists
 - Arrays
 - Geometry
 - Simple Linear Algebra
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Requirements

- 3 Assigned Projects
 - Simple
 - Interactive
 - 3D
 - Term Project and Presentation
 - You pick
 - Midterm and final exams
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Resources

- Can run OpenGL on any system
 - Windows
 - Linux
 - Mac
 - Get GLUT from web if needed
 - Labs: Dion 303, Dion 311
 - Accounts: see Paul or Miles
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References

- Other helpful references
 - OpenGL: A Primer, Ed Angel, Addison-Wesley, (Second Edition), 2005
 - Designed for students who need more programming information
 - The OpenGL Programmer's Guide (the Redbook) and the OpenGL Reference Manual (The Blue book), Addison-Wesley,
 - **The definitive references**
 - Web resources
 - www.opengl.org
 - www.cs.unm.edu/~angel
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Outline: Part 1

- Part 1: Introduction
 - Text: Chapter 1
 - What is Computer Graphics?
 - Applications Areas
 - History
 - Image formation
 - Basic Architecture
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Outline: Part 2

- Part 2: Basic OpenGL
 - Text: Chapters 2-3
 - Architecture
 - GLUT
 - Simple programs in two and three dimensions
 - Interaction
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Outline: Part 3

- Part 3: Three-Dimensional Graphics
 - Text: Chapters 4-6
 - Geometry
 - Transformations
 - Homogeneous Coordinates
 - Viewing
 - Shading
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Outline: Part 4

- Part 4: Implementation
 - Text: Chapter 7
 - Approaches (object vs image space)
 - Implementing the pipeline
 - Clipping
 - Line drawing
 - Polygon Fill
 - Display issues (color)
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Outline: Part 5

- Part 5: Others
 - Text: Chapters 8-11
 - Discrete techniques
 - Programmable pipelines
 - Modeling
 - Curves and surfaces
 - Advanced rendering
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What is Computer Graphics?

Computer Graphics

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

- In this lecture, we explore what computer graphics is about and survey some application areas
 - Display of information
 - Design
 - Simulation and animation
 - User interfaces
 - We start with a historical introduction
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Example

- Where did this image come from?

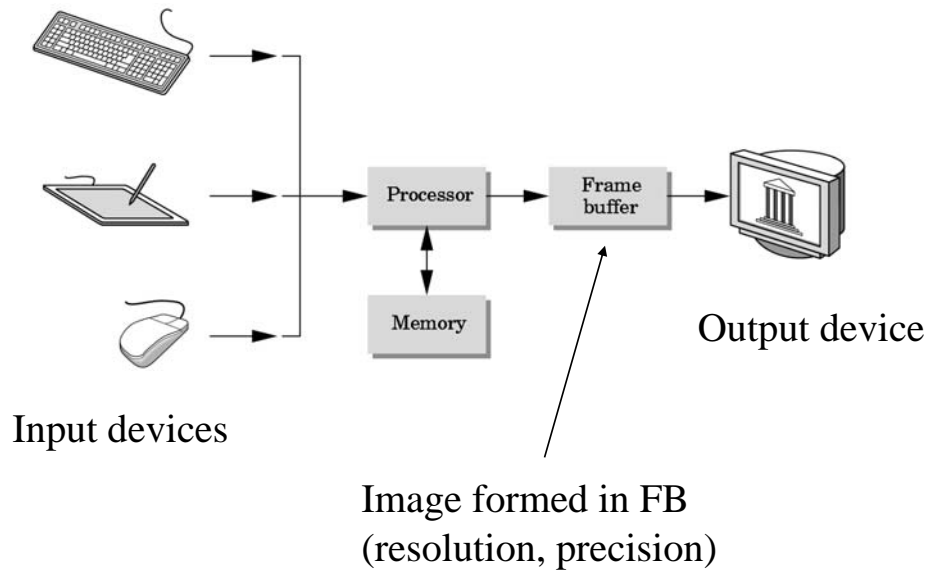


- What hardware/software did we need to produce it?
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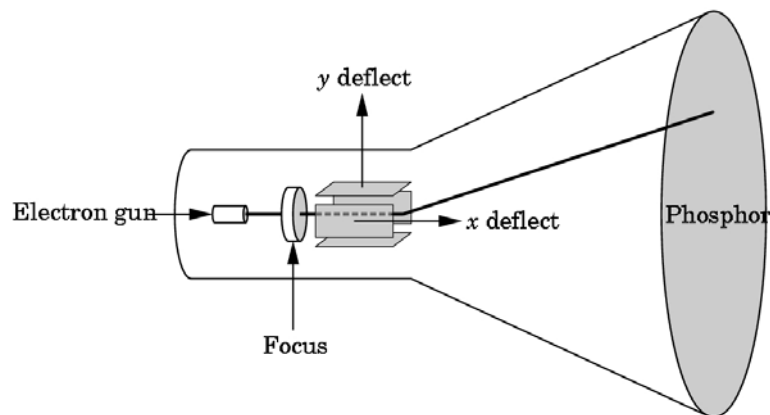
Preliminary Answer

- **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
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Basic Graphics System



CRT (Cathode Ray Tube)



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

Light-emitting diodes (LEDs)

Liquid-crystal displays (LCDs)

After Class

- Read the following
 - Chapter 1
 - Learn OpenGL
 - Check out OpenGL tutorial programs
<http://www.xmission.com/%7Enate/tutors.html>
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