1. Introduction to CG (16/01/24) Lecture-2

15 January 2024   13:56

Main Source:

I. Various sources from internet

II. Digital image fundamentals: Digital Image Processing, 4th edition, Book by Rafael C. Gonzalez and Richard E. Woods

III. Fundamentals of Computer Graphics by Peter Shirley and Steve Marschner.

IV. Computer Graphics by Foley, vanDam, Feiner, Hughes.

V. Computer Graphics by Donald Hearn and M. Pauline Baker

V. Computer Vision: Algorithms and Applications by Richard Szeliski

Syllabus:

Basic raster and vector graphics: Scan conversion algorithms for line, circle, and ellipse.

Filling: seed fill and polygon filling. Clipping lines and polygons.

Geometrical transformations: 2D and 3D transformations, homogeneous coordinates, composition of transformations, the Window-to-Viewport transformation, matrix representation of transformations.
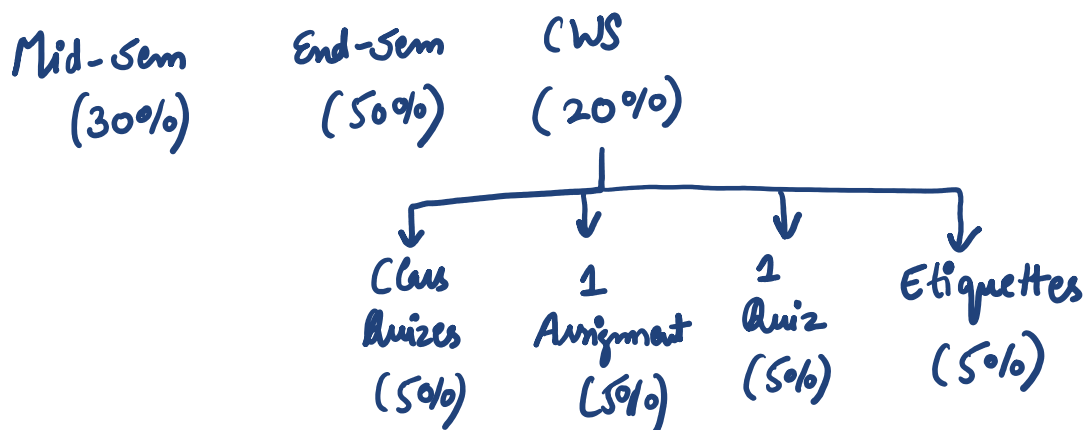
Projections: mathematics of planar geometric projections, implementation of planar geometric projections.

Visible surface determination: object space and image space techniques for visible surface detection, algorithms, z-buffer, list priority, scan line, area subdivision, back face removal, BSP tree and ray tracing algorithms.

Illumination and shading: illumination models, shading for polygons, constant, Gouraud and Phong shading models.

Curves: parametric cubic curves, Hermite, Bezier and Bspline curves.

Marking Scheme :—

Mid-Sem (30%)   End-Sem (50%)   CWS (20%)

Class Quizes (50%)   1 Assignment (50%)   1 Quiz (50%)   Etiquettes (50%)

Computer Graphics: Creation and manipulation of images using computers.

I. Major Applications:

1. Visual Effects (VFX):

VFX (Avengers Infinity War, 2018)

Before   After

2. Animation

Animation (Into the Spiderverse, 2018)

3. Gaming

Gaming (Breath of the Wild, 2023)

4. Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM)
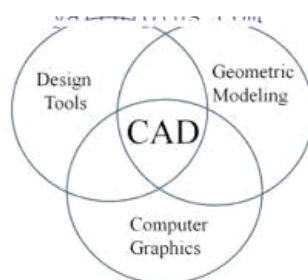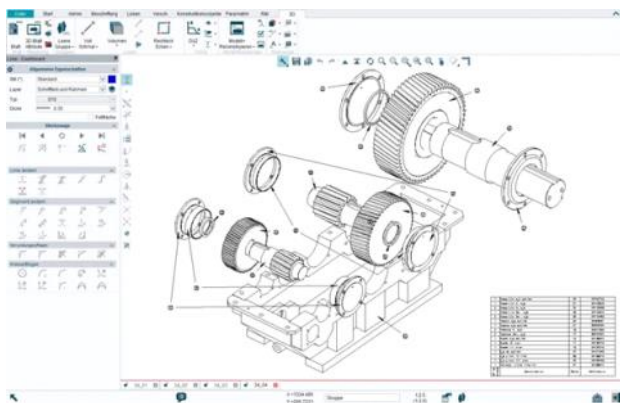

Fig. 1.4. CAD

5. Simulations

Fig. 1.1.xxx

5. Simulations

6. Medical Procedures

7. Virtual Reality

8. More recently:

8. **More recently:**

   --> **CycleNet: https://hbertiche.github.io/CycleNet/**

   --> **Controllable Animations: https://controllable-cinemagraphs.github.io/**
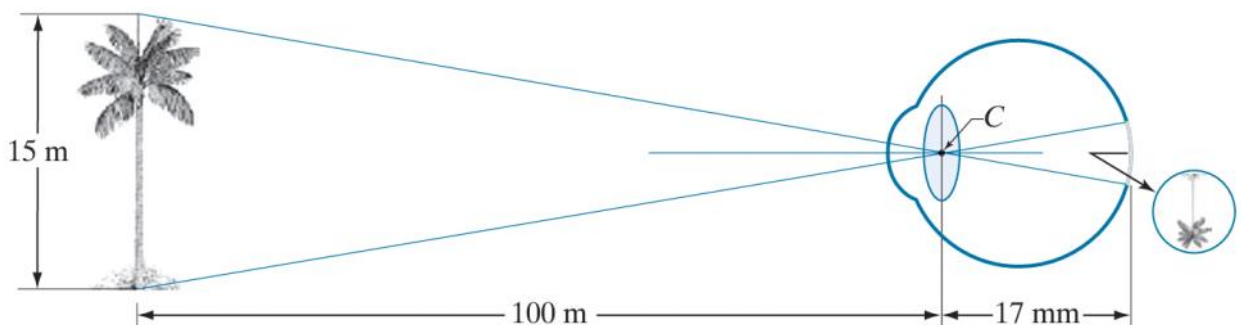

Discussion:

1. Miscellaneous Math --> Recap within the course.


2. C v/s Python


II. Digital Image Fundamentals

Image formation in the eye

The human eye works like a sophisticated biological camera, skilfully capturing and understanding the visual world. Light, with its different colours and brightness levels, enters through the clear cornea and passes through the lens inside the eye. This complex interaction of optics allows the eye to focus and project a clear image onto the retina at the back. The retina has millions of light-sensitive cells, called rods for low-light vision and cones for colour perception in bright light. When light hits these cells, it starts chemical reactions that create electrical signals. These signals travel through the optic nerve to the brain, where intricate processing constructs the visual experience. The brain combines information from both eyes to create a 3D and dynamic representation of the scene.

Digital Image Acquisition

Output (digitized) image

Imaging system

(Internal) image plane

Scene

a
b c d e
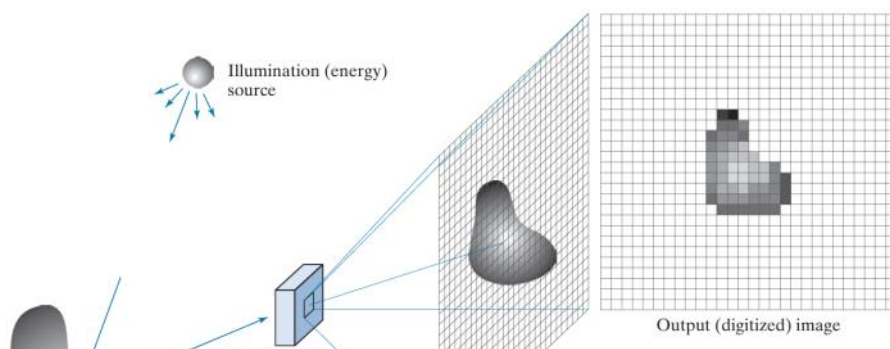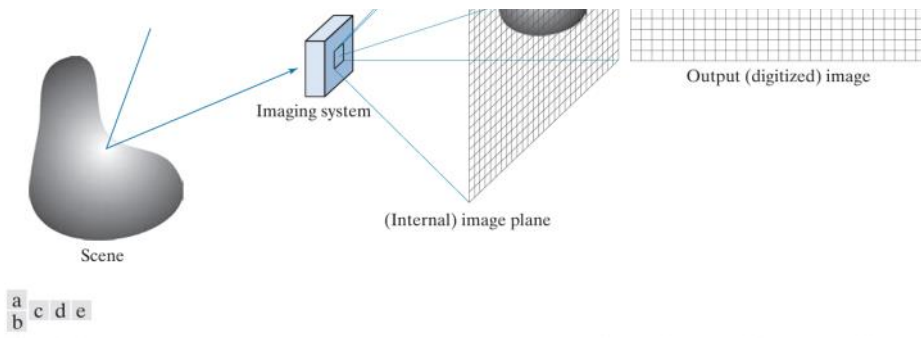
FIGURE 2.15 An example of digital image acquisition. (a) Illumination (energy) source. (b) A scene. (c) Imaging system. (d) Projection of the scene onto the image plane. (e) Digitized image.