UNIT-4

Video and Animation:

⊛. Video Signal Representation:

Video signal representation is the process of presenting the visual signals. In conventional TV set or monitors the video signal is displayed using CRT (Cathode Ray Tube). An electron beam sweeps the screen from top to bottom beam carrying the corresponding pattern information. The major aspects of video signal representation are:

1) Visual Representation: The objective of visual representation is to offer the viewer a sense of presence in the scene and participation in the events portrayed. Important measures are:

i) Vertical detail and viewing distance: The geometry of field occupied by the television image is based on the ratio of the picture width W to height H. It is called aspect ratio. The conventional aspect ratio is $4/3 = 1.33$

ii) Horizontal detail and picture width: The picture width chosen for conventional television service is $4/3$ x picture height. Using the aspect ratio, we can determine the horizontal field of view from the horizontal angle.

iii) Total Detail Content of the image:

Vertical resolution = no. of pixels in picture height.
horizontal resolution = no. of pixels in picture width.

The product of no. of pixels vertically and horizontally equals the total number of picture elements/pixels in the image.

iv) Perception of Depth: It depends upon angular separation of the image received by two eyes of the viewer. In case of flat screen of TV, a considerable degree of depth is inferred from the perspective appearance of the subject matter.

v) Luminance and Chrominance: Color vision is achieved via intensity of RGB in each portion/part of screen. However, during the transmission of signal from camera to display, a different color encoding that uses luminance and two chrominance signals are used.

vi) Temporal aspects of illumination: In contrast to continious pressure, wave of an acoustic signal, can be recognised as a continious sequence. To represent visual reality, following two conditions needs to be satisfied.

→ Rate of repetition of the images must be high enough to gurantee smooth motion from frame to frame.

→ The rate must be high enough so that presistence of vision extends over intervals between flashes.

vii) Continuity of motion: Continuity of motion is recognised at any frame rate faster than 15 frames per second. Smooth video motion is achieved at 30 fps. Movies, basically uses 24 frame per second.

viii) Flickering: Through a slow motion, a flicker effect arises. The marginal value to avoid flicker is at least 50 refresh cycles/s. To achiere continious flicker-free motion, we need a relatively high refresh frequency.

2) Transmission: NTSC (National Television Systems Committee) is the oldest standard for transmission and reception of video signals. For transmission of video signal, it consist of one luminance and two chrominance signals. To encode color, a video signal is composed of three different signals:

i) RGB signal: Consist of Red, Green and Blue color and their combination.

ii) YUV signal: YUV signal is technique that seperates brightness information ~~from~~ (Luminance-Y) from color information (chrominance channels U and V).

Component division for YUV signal;

$$Y = 0.30R + 0.59G + 0.11B$$
$$U = (B-Y) \times 0.493$$
$$V = (R-Y) \times 0.877$$

iii) YIQ Signal: YIQ signal is similar to YUV signal with following NTSC format.

$$Y = 0.30R + 0.59G + 0.11B$$
$$I = 0.60R - 0.28G - 0.32B$$
$$Q = 0.21R - 0.52G + 0.31B.$$

3) Digitalization:

It consist of sampling gray (color) level in the picture at MxN array of points and converts it to bit streams. The next step in creation of digital motion video is to digitize pictures in time and get a sequence of digital images per second that approximates analog motion video.

⊛. Computer Video Formats:

i) CGA (Color Graphics Adaptor): It has resolution of 320x200 pixels with simultaneous presentation of 4 colors and storage capacity per image is: $320 \times 200 \text{ pixels} \times \frac{2 \text{ bits/pixel}}{8 \text{ bits/byte}} = 16,000 \text{ bytes}.$

ii) EGA (Enhanced Graphics Adaptor): Supports resolution of 640x350 pixel with 16 color presentation. The storage capacity per image is:

$$640 \times 350 \text{ pixels} \times \frac{4 \text{ bits/pixel}}{8 \text{ bits/byte}} = 112,000 \text{ bytes}.$$

iii) VGA (Video Graphics Array): Works mostly with resolution of 640x480 pixels. In this case, 256 colors can be displayed simultaneously. The storage capacity per image is:

$$640 \times 480 \text{ pixels} \times \frac{8 \text{ bits/pixel}}{8 \text{ bits/byte}} = 307,200 \text{ bytes}.$$

iv) XGA (Extended Graphics Array): Supports a resolution of 640×480 pixels and 65,000 different colors. The storage capacity per image is:

$$640 \times 480 \text{ pixels} \times \frac{20.48 \text{ bits/pixel}}{8 \text{ bits/byte}} = 786,432 \text{ bytes.}$$

v) SVGA (Super VGA): Supports a resolution of 1024×768 pixels, and color formats up to 24 bits per pixel. The storage capacity per image is:

$$1024 \times 768 \text{ pixels} \times \frac{24 \text{ bits/pixel}}{8 \text{ bits/byte}} = 2,359,296 \text{ bytes.}$$

⊛. Computer Based Animation:

Computer based animation is an animation performed by computer using graphical tools to produce visual effects. To animate something is like injecting a life to it. Following are the basic steps for computer based animation:

i) Input Process: At the initial stage of generating animation, the drawing must be digitized in order to generate key frames. For digitizing the drawings the method of optical scanning, tracing along with data tablet is used. Thus digitized image should be kept in key frames at extreme or characteristics portion that has to be animated.

ii) Composition stage: In this stage the foreground and background figures are combined to generate the individual frames for the final animation.

iii) In between process: The animation of movement from one position to another needs a composition of frames with intermediate frames in between key frames. This is called in between process, which is created out by the interpolation method. In interpolation method system gets only starting and ending position. The easiest interpolation method is linear interpolation.

iv) Changing colors: For changing colors, computer aided animation uses CLUT (color lookup table) in a frame buffer and the process of double buffering. The lut animation is generated by manipulating the color lookup table. The simplest method is to cycle the colors in the lut.

⑧. Animation Language:

Different languages for describing animation are:-

i) Linear-list Notations: Linear-list notation language is animation supporting language where each event in the animation is described by starting and ending frame number and an action that has to take place. SCEFO (Scene Format) is an example of linear-list notation.

Example:- 45, 53, B, rotate, "palm", 1, 30.

Here, starting frame number ⇒ 45
ending frame number ⇒ 53
B ⇒ table.
Rotate ⇒ action.
Palm ⇒ object
1 ⇒ straight angle
30 ⇒ end angle

OR: From 42 frame no. to 53, rotate the object called palm about axis 1 by 30 degrees.

ii) Graphical language: Graphical language describe animation in a more visual way than textual languages. This language is used for expressing and editing the changes in an animation. AutoCAD is an example of graphical language.

iii) General Purpose language: It is a high level language developed for normal application software development that support the features of animation along with graphic drawing. Example: QBASIC, C, C++, Java etc.

⊛. Methods for controlling animation:

Different methods for controlling animation are;

i) **Full explicit control:** It is the simplest type of control. In this animator provides the entire information of entire events that could occur in the animation. The animator may specify changes such as translation, scaling, rotation.

ii) **Procedural control:** It is based on communication between various objects to determine their properties. In physically -based system, the position of one object may influence the motion of another object. In actor-based systems actors pass their position to other actors to affect their behaviour.

iii) **Constraint-based systems:** Moving object with which they are in contact, such motion is known as compound motion. Compound motion may not be linear at all, such motion can be modeled by constraint.

iv) **Tracking live action:** Live action can be tracked to generate trajectories of objects in the course of an animation.

v) **Kinematics and Dynamics:** Kinematics refers to the position and velocity of points. Kinematics describes the scene. Dynamics takes the account of physical laws of movement that governs the kinematics.

⊛. Display of Animation:

→ To display animations with raster systems, animated objects must be scan converted in their pixmap in frame buffer.

→ To show a rotating object we can scan-convert into the successive pixmap views.

→ Scan-conversion provides a smooth effect.

→ The frame buffer is divided into two images, each with half of bits per pixel of overall frame buffer.

⊛. Transmission of Animation:

For the transmission of animation following two different techniques are used:

1) **Symbolic Representation:** It is the graphical description of an animated object along with operation command. Animation is displayed at the receiver end by scan-conversion of objects into pixmap. Transmission time is short as symbolic representation is smaller than pixmap representation but display time is longer since scan conversion has to be done at receiver's end. Transmission rate depends upon:
   - → Size of symbolic representation structure, size of operation structure.
   - → Number of animated objects and commands.

2) **Pixmap Representation:** It has longer transmission time than symbolic representation because of large data size in pixmap. It has shorter display time because no scan-conversion has to be done at receiver's end.

   Transmission rate = size of pixmap × frame rate.