

# **INTRODUCTION TO MULTIMEDIA AND ANIMATION**

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## **10.1. INTRODUCTION TO MULTIMEDIA**

The word multimedia is composed of two parts: the prefix multi and the root media. The prefix multi means multiple and the root media which is plural of medium means "a means to distribute represent and transfer the information."

Hence we can define Multimedia as combination of text, graphics, art, sound, animation and video elements. From the users perspective the multimedia is to represent information through audio, video, in addition to text, image, graphics and animation. For example, using audio and video, a variety of dynamic situations in different areas can often be presented better than just using text and image alone.

## **10.2. BASIC DEFINITIONS**

**Multimedia:** Multimedia, as described earlier, is a combination of manipulated text, pictures, art, graphics, sound, animation and video elements and is delivered to you by computer or other electronic means.

**Interactive Multimedia:** It is a media with which user can interact or control i.e. when a user or viewer is allowed to control the elements (sound, image, video etc.) that are delivered is called as interactive multimedia.

Whereas when the user or viewer is not allowed to control elements of the multimedia than it is called as non-interactive multimedia.

**Linear Multimedia:** A project does not need to be interactive to be called as multimedia.

The user or a viewer just sits back and watch it like they do when watch movie or television such projects are called as linear multimedia. On the other hand, when users are given a navigational control and can move through the content of the project, that multimedia is referred as non-linear multimedia.

**Multimedia Highway:** When information provider and content owners wants to see their product online. The information elements will link up online as distributed resources on data highway where user need to pay to acquire and use multimedia based information.

**Hypertext and Hyper media:** Hypertext is basically the same as regular text it can be stored, read, searched or edited. It is a text with a pointer to other text.

**Hyper Media:** Hyper media is a superset of Hypertext. Hyper media documents contains links not only to other pieces of text but also to other forms of media like sound, image, movies etc. A Hyper media simply combines Hypertext and multimedia.

### 10.3. MULTIMEDIA CHARACTERISTICS

- A Multimedia system has four basic characteristics.
- Multimedia systems must be computer controlled.
- Multimedia systems are integrated.
- The information they handle must be represented digitally.
- The interface to the final presentation of media is usually interactive.

### 10.4. DESIRABLE FEATURES OF MULTIMEDIA SYSTEM

Given the above challenges the following feature a desirable (if not a prerequisite) for a Multimedia System:

#### **Very High Processing Power**

Needed to deal with large data processing and real time delivery of media. Special hardware common place.

#### **Multimedia Capable File System**

Needed to deliver real-time media—e.g. Video/Audio Streaming. Special Hardware/Software needed e.g. RAID technology.

#### **Data Representations/File Formats that support multimedia**

Data representations/file formats should be easy to handle yet allow for compression/ decompression in real-time.

#### **Efficient and High I/O**

Input and output to the file subsystem needs to be efficient and fast. Needs to allow for real-time recording as well as playback of data. e.g. Direct to Disk recording systems.

#### **Special Operating System**

To allow access to file system and process data efficiently and quickly. Needs to support direct transfers to disk, real-time scheduling, fast interrupt processing, I/O streaming etc.

#### **Storage and Memory**

Large storage units (of the order of 50-100 GB or more) and large memory (50-100 Mb or more). Large Caches also required and frequently of Level 2 and 3 hierarchy for efficient management.

### **Network Support**

- Client-server systems common as distributed systems common Software Tools.
- User friendly tools needed to handle media, design and develop applications, deliver media.

## **10.5. APPLICATIONS OF MULTIMEDIA**

Multimedia finds its application in various areas including, but not limited to, advertisements, art, education, entertainment, engineering, medicine, mathematics, business, scientific research and spatial, temporal applications. A few application areas of multimedia are listed below:

### **Creative Industries**

Creative industries use multimedia for a variety of purposes ranging from fine arts, to entertainments, to commercial art, to journalism, to media and software services provided for any of the industries listed below. An individual multimedia designer may cover the spectrum throughout their career. Request for their skills range from technical, to analytical and to creative.

### **Commercial**

Much of the electronic old and new media utilized by commercial artists is multimedia. Exciting presentations are used to grab and keep attention in advertising. Industrial, business to business, and interoffice communications are often developed by creative services firms for advanced multimedia presentations beyond simple slide shows to sell ideas or liven-up training. Commercial multimedia developers may be hired to design for governmental services and nonprofit services applications as well.

### **Entertainment and Fine Arts**

In addition, multimedia is heavily used in the entertainment industry, especially to develop special effects in movies and animations. Multimedia games are a popular pastime and are software programs available either as CD-ROMs or online. Some video games also use multimedia features. Multimedia applications that allow users to actively participate instead of just sitting by as passive recipients of information are called interactive Multimedia.

### **Education**

In Education, multimedia is used to produce computer-based training courses (popularly called CBTs) and reference books like encyclopedia and almanacs. A CBT lets the user go through a series of presentations, text about a particular topic, and associated illustrations in various information formats. Edutainment is an informal term used to describe combining education with entertainment, especially multimedia entertainment.

### **Engineering**

Software engineers may use multimedia in Computer Simulations for anything from entertainment to training such as military or industrial training. Multimedia for software interfaces are often done as collaboration between creative professionals and software engineers.

## Industry

In the Industrial sector, multimedia is used as a way to help present information to shareholders, superiors and coworkers. Multimedia is also helpful for providing employee training, advertising and selling products all over the world via virtually unlimited web-based technologies.

## Mathematical and Scientific Research

In Mathematical and Scientific Research, multimedia is mainly used for modeling and simulation. For example, a scientist can look a molecular model of a particular substance and manipulate it to arrive at a new substance. Representative research can be found in journals such as the journal of Multimedia.

## Medicine

In Medicine, doctors can get trained by looking at a virtual surgery or they can simulate how the human body is affected by diseases spread by viruses and bacteria and then develop techniques to prevent it.

## Multimedia in Public Places

In hotels, railway stations, shopping malls, museums, and grocery stores, multimedia will become available at stand-alone terminals or kiosks to provide information and help. Such installation reduces demand on traditional information booths and personnel, and value, and they can work around the clock, even in the middle of the night, when live help is off duty. A menu screen from a supermarket kiosk that provide services ranging from meal planning to coupons. Hotel kiosk list nearby restaurant, maps of the city, airline schedules, and provide guest services such as automated checkout. Printers are often attached so users can walk away with a printed copy of the information. Museum kiosk are not only used to guide patrons through the exhibits, but when installed at each exhibit, provide great added depth, allowing visitors to browser though richly detailed information specific to that display.

## 10.6. VIRTUAL REALITY

At the convergence of technology and creative invention in multimedia is virtual reality, or VR. Goggles, helmets, special gloves, and bizarre human interfaces attempt to place you "inside" a lifelike experience. Take a step forward, and the view gets closer, turn your head, and the view rotates. Reach out and grab an object; your hand moves in front of you. Maybe the object explodes in a 90-decibel crescendo as you wrap your fingers around it. Or it slips from your grip, falls to the floor, and hurriedly escapes through a mouse hole at the bottom of the wall.

VR requires terrific computing horsepower to be realistic. In VR, your cyberspace is made up of many thousands of geometric objects plotted in three-dimensional space: the more objects and the more points the describe the objects, the higher resolution and the more realistic your view. As the user moves about, each motion or action requires the computer to recalculate the position, angle size, and shape of all the objects that make up your view, and many thousands of computations must occur as fast as 30 times per second to seen smooth.

## 10.7. BASIC CONCEPTS OF SOUND AND AUDIO

Sound is one of the important building block in any multimedia presentation and the project and is the simplest type of multimedia data. The presence of the sound in a multimedia presentation increases

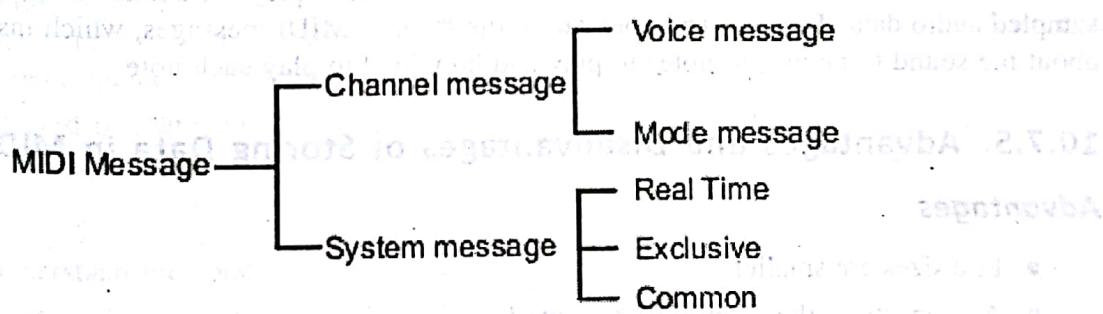
the quality of the most graphic based presentations especially if the presentation consists of either a video or animation. In this section we study about the MIDI sounds and its specifications .we will also study about the Digital Audio, difference between the MIDI and Digital Audio and finally see the file formats of sound/audio.

### 10.7.1. MIDI (Musical Instrument Digital Interface)

MIDI was first defined in 1982 by Gordon Hall.MIDI is the industry-Standard Protocol that was adopted by industries to enable the computers, synthesizers, keyboards, and other musical instruments to communicate with each other. Most of the synthesizers supports the MIDI standard, thus the sound created on one synthesizer can be played back and manipulated on the other synthesizer and sounds almost the same. The same way two computers communicate using modems or any connecting device the same way two synthesizers communicate through MIDI.MIDI information can be used in order to indicate the starting and the end point of a song.

### 10.7.2. MIDI Specifications

**MIDI Message:** A MIDI Message is a sequence of instructions that controls some aspect of the performance of an instrument. MIDI messages are typically three bytes long: a status byte. The most significant bit of status byte is set to 1, 4 low-order bits identify which channel it belongs to (four bits produce 16 possible channels) while the 3 remaining bits identify the message. The other two are called data bytes, provides the additional parameters on how to perform the indicated operations. Status and data bytes are distinguished by the value of the MSB (most-significant bit); the MSB is set to a "1" for status bytes, and is cleared to a "0" for data bytes.



MIDI Messages are classified as either Channel Message and System message. The Channel Message are the messages that are transmitted on individual channels rather than globally to all devices in the MIDI network. The Channel Message consists of voice Messages and mode messages. A voice message instruct the receiving instrument to assign particular sounds to its voice and can also alters the sound of the currently active note or notes. A mode messages determine how an instrument will process MIDI voice messages. The System Message carry information that is not channel specific, such as timing signal for synchronization, positioning information in pre-recorded MIDI sequences, and detailed setup information for the destination device.The System Messages are classified as Real-Time, Exclusive and Common System Messages. The Real-Time System Messages are related to synchronization for all the clock-based Equipment within a system.some of the example of System Real-Time Message includesTiming Clock , Start Sequence, Continue Sequence, Stop Sequence, Active Sensing System Reset.The Exclusive System Messages are those messges which are related to things that cannot be standardized. They are used to send the data such as patch parameter and sample data between the two MIDI devices. The Common System Message are projected for all the receivers in the system.These Systems contains some unrelated messages like, MIDI Timing Code,Song Position Pointer, Song Select and Tune Request.

### **10.7.3. MIDI Hardware**

MIDI is an asynchronous serial interface. The baud rate is 31.25 Kbaud (+/- 1%). There is 1 start bit, 8 data bits, and 1 stop bit (ie, 10 bits total), for a period of 320 microseconds per serial byte. The MIDI circuit is current loop, 5 mA. Logic 0 is current ON. One output drives one (and only one) input. To avoid grounding loops and subsequent data errors, the input is opto-isolated. It requires less than 5 mA to turn on. The Sharp PC-900 and HP 6N138 opt isolators are satisfactory devices. Rise and fall time for the optoisolator should be less than 2 microseconds. The standard connector used for MIDI is a 5 pin DIN. Separate jacks (and cable runs) are used for input and output, clearly marked on a given device (ie, the MIDI IN and OUT are two separate DIN female panel mount jacks). 50 feet is the recommended maximum cable length. Cables are shielded twisted pair, with the shield connecting pin 2 at both ends. The pair is pins 4 and 5. Pins 1 and 3 are not used, and should be left unconnected. A device may also be equipped with a MIDI THRU jack which is used to pass the MIDI IN signal to another device. The MIDI THRU transmission may not be performed correctly due to the delay time (caused by the response time of the opto-isolator) between the rising and falling edges of the square wave. These timing errors will tend to add in the "wrong direction" as more devices are daisy-chained to other device's MIDI THRU jacks. The result is that there is a limit to the number of devices that can be daisy-chained.

### **10.7.4. MIDI File Format**

The MIDI specification made the provision which saves the synthesizers sound into a separate file format called as MIDI files. Midi files are compact then that of the WAV files. A typical MIDI file consumes less than 10Kbytes of the data per minute of the sound as compared to a file that contains high quality stereo sampled audio which requires about 10Mbytes of data/minute of the sound, the reason is that midi files contains only the instructions needed by a synthesizer to play the sounds and does not contain the sampled audio data. These instructions are in the form of MIDI messages, which instruct the synthesizer about the sound to be used, to notes to play and how loud to play each note.

### **10.7.5. Advantages and Disadvantages of Storing Data in MIDI Files**

#### **Advantages**

- File sizes are smaller
- All aspects of the sound can be edited
- Effects can be applied to individual instruments
- No interference or background noise during recording
- Can use to create music without need for different musicians / instruments

#### **Disadvantages**

- Dependent on quality of sound card for overall sound
- Can not store vocals
- Effects are limited
- Less realistic sounds than actual instruments

## 10.8. MULTIMEDIA AUTHORING TOOLS

Multimedia authoring tools provide the framework for organizing and editing the elements of a multimedia project. Authoring softwares provide an integrated environment for combining the content and functions of a project. The authoring tools enables the developers to combine text, graphics, audio, video and animation into an interactive presentation or project. The Authoring system include the editing tools to create, edit and convert multimedia elements such as animation and video clips. The multimedia Authoring tools are used for intractively and user interface, for presenting the project on screen and for assembling different multimedia elements into single, cohesive product.

### Types of Multimedia Authoring Tools

Based on the method used for sequencing or organizing multimedia elements and events, authoring tools are grouped into groups.

1. Card and Page Based tools
2. Icon-based, event driven tools
3. Time-Based Tools
4. Web Based Tools

#### 10.8.1. Card and Page Based Tools

This tool provide a simple and easily understands metaphor for organizing multimedia elements, wherein the elements are arranged as we have pages organized in a book. It contains media objects such as buttons, text fields, graphic objects etc. These tools are best used when the bulk of content consists of those elements that can be viewed as individual. They provides the facility of linking objects to pages or cards in organized sequence so that user can move on to any pages.

Softwares for card or Page Based tools are Hypercard-linked cards are ToolBook-each page is a screen.

#### Advantages

1. Easy to understand metaphor
2. Single screen = single page
3. Easy to use as it provides templates and have short development time.

#### Disadvantages

1. Some run only on one platform.
2. Tools are not as powerful as equivalent stand alone.

#### 10.8.2. Icon Based-Event Driven Tool

Icon or object based authoring tool is the simplest and easiest authoring process. In this tool multimedia elements and interaction cues are organized as object in a flowchart. The flowchart can be built by dragging appropriate icons from a library, and then adding the content. The Icon based event driven tool simplifies the organization of the project and displays the flow chart diagrams for the activities along the branching path.

The software used in Icon-based event driven tools are Authorware and Icon Author.

### **Advantages**

1. Clear Structures
2. Easy editing and updation

### **Disadvantages**

1. Difficult to learn
2. Expensive

### **10.8.3. Time Based Tools**

In this tool elements and the events are organised along a timeline with high resolution. This tool is best suited to those message in which there is begining and an end of the message. The graphic frames which are organized in a sequenital order can be played back on a speed set by the user of the tool. Some of the time based tools facilitate the navigation and interactive control where in the user can jump to any location in the sequence. Software for time Based Authoring tools are Adobis Director and Flash.

### **Advantages**

1. Good in animation creation.
2. Provides Branching, user control and interactivity.

### **Disadvantages**

1. It is Expensive.
2. Step learning curve for advanced features.

### **10.8.4. Web Based Authoring Tool**

Web based authoring tool can provide the power to build an interative, animated, state-of-art websites suitable for anything from a personal web page to a mid-size business site. Web designers don't need to know HTML to create discussion groups, pop-up windows navigation bars, animated pages etc. The software for Web Based Authoring tool are Net object Fusion, Microsoft Front Page and Macromedia Dreamweaver.

### **Advantages**

1. It is cheap and effective way to publish materials using online media.
2. Effective way to do self-promotion.

### **Disadvantage**

1. Potentially expose personal information to the public

### **10.9. IMPORTANCE OF VIDEO IN MULTIMEDIA**

With the increasing accessibility of technology for everyday people, things are starting to get digitalized: digital camera, digital cable, digital sound, and digital video. It is no longer the case where a video production is only possible for specialized studios. The availability of various user-friendly inexpensive tools is pushing motion pictures into individual computer owners. Motion Pictures or video is a combination of image and audio, which consists of a group of still images called as frames. These frames are displayed one after the other in a specific sequence and at a specific speed which is known as

frame rate, which is the measure of number of frames/second (fps). When the frames are displayed at a particular speed human eye cannot distinguish the individual frames, also the persistence of vision merges each individual frames with each other which creates an illusion of motion. The integration of video in multimedia applications is way which conveys the information that can include a personal element which other media lack and effectively convey a great deal of information in the least amount of time. Video can enhance, dramatizes, and gives impact to a multimedia application.

### 10.9.1. Digitization of Video

Digital video refers to the capturing, manipulation, and storage of moving images that can be displayed on computer screens. This requires that the moving images be digitally handled by the computer. The word digital refers to a system based on discontinuous events, as opposed to analog, a continuous event. Computers are digital systems; they do not process images the way the human eye does.

Before the Digital video, to display analog video images on a computer monitor, the video signal had to first be converted from analog to digital form. A special video digitalizing overlay board or hardware on the motherboard had to be installed in computer to take the video signal and convert it to digital information. To do this, however, required a very powerful computer to be able to read and digitalize every frame repetitively. So the next step in digital video evolution was to eliminate the analog videotape. Thus, the entire procedure, including the capturing of video, is in digital form. First, a camera and a microphone capture the picture and sounds of a video session and send analog signals to a video-capture adapter board. The board only captures half of the number of frames per second that movies use in order to reduce the amount of data to be processed. Second, there is an analog-to-digital converter chip on the video-capture adapter card, and it converts the analog signals (waves) to digital patterns (0s and 1s). Third, a compression/decompression chip or software reduces the data to a minimum necessary for recreating the video signals. In this procedure, no analog was involved, making the process more efficient.

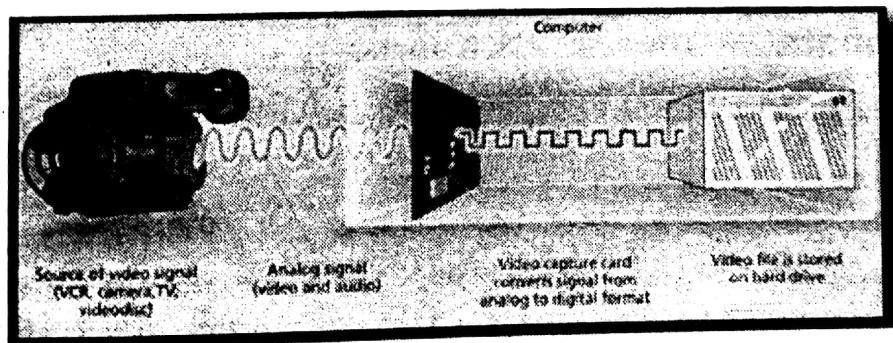


Fig. 10.1.

### 10.9.2. Broadcasting and Video Standards

NTSC (National Television Systems Committee) countries including Korea, Japan, Canada, USA and other countries also uses this broadcasting system. NTSC was set up by Federal Communications Commission in 1940, in USA and established NTSC a nation wide standard for black and white TV transmission. As specified by the NTSC standard it uses 525 horizontal lines drawn onto the inside face of a phosphor-coated picture tube every 1/30th of a second by a fast-moving electron beam, 30 frames per sec, 2 interlaced fields per sec, 262.5 lines per field, 60 fields per sec, aspect ratio of 4:3 and frequency modulation for the audio signals.

**PAL (phase alternating line)** is a television standard which was originally developed by a German scientist Walter Bruch in 1967. This standard is used in Europe, Asia, Africa, and Australia. It uses 625 scan lines at the rate of 25 frames per sec, with an aspect ratio of 4:3 and an interlacing of 2:1 with 2 fields per frame to improve the picture quality, chroma signals have alternate signs (+U and -U) in successive scan line hence it is called as "phase alternating lines". PAL uses the YUV color model with an 8 MHz channel and allocate a bandwidth of 5.5 MHz to Y and 1.8 MHz to U and V. The PAL color sub components are referred to as U and V and are defined according to the following relations:

$$Y = 0.3R + 0.59G + 0.11B$$

$$U = 0.493Cb = 0.493(B-Y) = -0.147R - 0.289G + 0.436B$$

$$V = 0.877Cr = 0.877(R-Y) = 0.615R - 0.515G - 0.100B$$

**SECAM (Sequential Color and Memory)** this television standard was invented by French and was third major broadcast tv standard. Similar to PAL, in SECAM, the original design had higher number of horizontal lines but finally settled for 625 horizontal lines per frame, at a frame rate of 25 frames per sec, with 4:3 aspect ratio and interlaced fields but unlike PAL, in SECAM, U and V signals are modulated using separate color sub components at 4.25 MHz and 4.41 MHz respectively.

**HDTV (High Definition Television)** this television standard was developed in order to improve the picture quality of the television that uses NTSC or PAL formats. Thus the difference between the conventional tv and hdtv is that the hdtv has much wider aspect ratio of 16:9 instead of 4:3 of NTSC and PAL. The other feature of HDTV is its movement towards the progressive scan. HDTV video recordings intended for broadcast are typically recorded either in 720p or 1080i format as determined by the broadcaster. 720p is commonly used for Internet distribution of high-definition video, because most computer monitors operate in progressive-scan mode. 720p also imposes less strenuous storage and decoding requirements compared to both 1080i and 1080p. 1080p-24 frame/s and 1080i-30 frame/s is most often used on Blue-ray Disc; as of 2011, there is still no disc that can support full 1080p-60 frame/s.

### 10.9.3. File Formats

**AVI (Audio/Video Interleaved):** AVI Stands for Audio Video Interleaved. It is one of the oldest formats. It was created by Microsoft to go with Windows 3.1 and it's "Video for Windows" application. AVI format can contain both audio and video in the same file as many video files contains both video and audio. The term interleaved means that within the file the video data and corresponding audio data are kept in small chunks instead of widely separate blocks. The size of the AVI file are large as the image frames and the audio are stored without any compression. Even though it is widely used due to the number of editing systems and software that use AVI by default, this format has many restrictions, specially the compatibility with operations systems and other interface boards.

**MOV (Quick time Movie):** MOV format, is developed by Macintosh, is the proprietary format of the QuickTime application. It can also run on PCs. Being able to store both video and sound simultaneously, the format was once superior to AVI. MOV is a compressed format and uses many CODECs. The latest version of QuickTime also has streaming capabilities for internet video. However, with the new MPEG-2 format, the MOV format started to lose its popularity, until it was decided that the MPEG-4 is to use the QuickTime format as the basis of its standards.

**MPEG:** MPEG (pronounced em-peg) stands for Moving Picture Experts Group. The term is generally used to name the set of digital video compression standards and file formats developed by this group. MPEG uses lossy compression, and achieves a high compression rate by storing only the changes from one frame to another and not the entire frame. There are two major standards. MPEG-1 provides a  $352 \times 240$

resolution at 30 frames per second. The product quality is a little below VCR videos. The MPEG-2 provides a  $720 \times 480$  and  $1280 \times 720$  resolutions at 60 frames per second, with full CD-quality audio. It can compress a two hour video into a few gigabytes.

MPEG-2 is sufficient for all major TV standards and DVD-ROM. MPEG-4 is in development (there is no MPEG-3), and will provide multiple views and multiple soundtracks of a scene, as well as stereoscopic and 3-D views.

## 10.10. ANIMATION

The word Animation is derived from the word 'animate' which means 'to give life to'. 'Animating' an object means to instruct movement to something which cannot move on its own. In order to animate something, the animator should be able to specify, either directly or indirectly, how the 'object' is to move through time and space.

### 10.10.1. Principles of Animation

Animation plays an important part in the multimedia applications. The dedicated hardware and software built into the system increases the animation speed. Animation is based on a biological phenomenon called as persistence of vision and psychological phenomenon called as Phi. An object seen by a person eye remains chemically mapped on the eyes retina for a brief amount of time after viewing. When combined with the persons mind conceptually completes the perceived action. Thus when the continuous series of still images changed very slightly and rapidly in a sequence one after the other gives a visual illusion of movement.

### 10.10.2. Animation Techniques

**Key Frames:** Animations are created by presenting a series of images quickly enough that the human eye doesn't sense an abrupt transition between the images. If the differences between adjacent images in the series are kept small enough, someone viewing the animation sees it as a smooth, changing scene instead of a series of images. Each static image in an animation is called a frame. The term originated from film technology. A strip of film is partitioned into a series of images that are separated from each other by thin, unused portions of film called frame lines. Together, the unused portions of the film and the edges of the film appear like a picture frame around each individual image. One method of creating an animation is to create each of the frames that you want to present individually. This method is called **Key framing**. It gives the animator precise control over the animation, but it is very labor-intensive. Another method is to create only some of the most important frames. The frames that you choose to create are called **Key frames** and are pivotal or complex members of the series of images.

The series of frames in between the key frames drawn into process called as **Tweeing**. Tweeing is the process of calculating the number of frames into between the key frames and the path that action takes.

**Cell Animation:** Cells are the clear celluloid sheets that were used for drawing each frames. A background is also drawn on a separate piece of opaque paper. When it comes to shooting the animation, the different characters are overlaid on top of the background in each frame. This method also saves time in that the artists do not have to draw in entire frames, but rather just the parts that need to change such as individual characters, even separate parts of a character's body are placed on separate pieces of transparent paper.

**Path Animation:** Path animation allows you to assign an object to move along the course of a curve, called a path. Path animation increases the complexity of an animation and provides motion, changing the location of an image along a predetermined path during specified amount of time.

### 10.10.3. 2D and 3D Animations

There are mainly two types of animation used in multimedia: 2D and 3D animation.

#### 2D Animation

It is the most common kind of animation. Wherein, flat images are drawn one frame at a time on a flat Cartesian x and y axis on the screen for example blinking word, color cycling logo, button or cells that changes their state on mouse roll over. This process is very time consuming but result obtained is amazing. Computer animation has increased the efficiency, and enhanced the results of cell animation with introduction of wide ranges of color and speed. Now, many animation packages are equipped with tweening Facility, that is, calculating the number of frames in between two previously created key frames. Thus, many steps required for cell-based animation can be eliminated making it very simple to do. The animation packages also involve some special effects.

**Morphing and Warping** are two commonly used special effects. Morphing (short form of metamorphosis) is the process of transformation of object shapes from one form to another. Morphing takes two images and seamlessly changes one image to another the second image actually seems to grow out of the first one. Morphing can also be used to show the pace of changes more clearly than photos. Warping is variation of the morphing where only one image is used to show various changes that take place. Warping process uses the key points of one image to create different effects, rather than mixing up two images.

#### 3D Animation

In 3-D animation mathematical model of 3-D object is created to realistically represent with the depth. 3-D animations follow mainly three steps; modeling, animation and rendering. Out of these three first two are very important and takes long time to finish. Modelling is the design phase where a 3-D object is created. In a 2-D animation an object can move up (called Y axis) and sideways (called X axis). But in the case of a 3-D model, a third axis is used: depth or the Z-axis. Once an object is created along these three axes, colour, Shading and light source can be added to the image to make it more realistic. In the second phase, the 3-D image is moved along a motion path, which is defined using key frames of the animation sequence. And in the final stage, the entire sequence is rendered to create a 3-D animation.

### 10.10.4. Animation Software

- 1. Adobe Flash:** Formerly, it was known as Macromedia flash and prior to this, it was Futures flash. It is in fact an IDE that refers to both Adobe flash player and the multimedia authoring program which are used to create applications like, websites, games, movies, etc. It has features to support both vector and raster graphics, the scripting language used with it is k.a Action script. So, Adobe flash is an IDE (integrated development environment). Flash players is important component of Adobe flash because, it is the virtual machine which is used to run or parse the flash files (traditionally flash files are called flash movies that have software extension). Now-a-days the flash technology is used very frequently to create interactive websites, Animation, Advertisements, etc.

- 2. Autodesk MAYA:** Autodesk Maya software is a powerful, integrated 3D modeling, animation, and rendering solution based upon an open architecture. Everything can be scripted or programmed using either of Maya software's two embedded scripting languages (MEL or Python scripting) or its well-documented and comprehensive API (Application Programming Interface). Maya is used by film and video artists, game developers, multimedia designers (both print and web), design

visualization professionals, and 3D enthusiasts to create engaging, lifelike digital images, realistic animation, and extraordinary visual effects.

3. **3D Studio:** 3DStudio is a 3D computer graphics programme. 3DStudio runs on PCs. It is relatively easy to use. Many schools and small time production studios use 3DStudio to satisfy their needs. 3DStudio is created by AutoDesl. 3DStudio consists of a 2D modeler, in which shapes can be drawn, a 3D Loft, in which 2D shapes can be extruded, twisted, or solidified to create 3D objects. Then, there is a 3D model, in which a scene is created. Finally, there is an animator in which key frames are assigned to create an animation and a material editor, in which a variety of textures can be created. Overall, this is a great program.
4. **3D Studio Max:** The successor to 3DStudio 3.0, 3DStudio Max runs under WindowsNT. It is entirely object oriented, featuring new improvements such as, volumetric lighting, space warps, and an all new redesigned interface.

#### 10.10.5. Controlling Animation

At the very highest level of 3D computer-generated animation software interfaces allows the animator to control different movement parameters to produce smooth movement across the frames. Described below briefly are the different methods of controlling animation.

- (i) **Full Explicit Control:** It is the simplest type of control where the animator either specifies simple changes like scaling, translation, rotation, or provides keyframe information and interpolation methods interactively.
- (ii) **Procedural Control:** It is based on certain kinds of behaviour that can be applied to objects, and the way they interact. In a *physically based system* the position of one object may influence the motion of another object (e.g., spotlight follows a dancer, a sunflower follows the sun). In such systems objects are modeled with physical attributes such as mass, moment of inertia, elasticity, velocity etc. and object behaviour as emulated in animation are based on laws of Newtonian Physics against applied external force. Thus moving objects can be made to collide realistically, or bounce off solid surface.
- (iii) **Kinematics:** It is the study of motion of bodies without reference to mass or force. That is it is only concerned with how things can move, rather than what makes them do so. Animations of linked objects or joined structures (e.g., limbs of human or animal figures) are controlled by imposing *kinematic constraints* obeyed by real objects or structures. For example, a 3D model of a door must have the same degree of freedom to move/rotate as a real door has with the movement constraints provided by the hinges.

Kinematics being a general term, *forward kinematics* and *inverse kinematics*—both are used in controlling animation. While the former deals with linked motions from cause to the effect, the inverse kinematics works backward from effect to cause. For example, it is the motion of the upper arm that propels the rest of the arm and hand. Modeling the hand's position from movement and position of the upper arm requires forward kinematics. Whereas, first fixing the position of the hand and then backtracking to find the relevant motion of upper arm is what inverse kinematics is and sometimes it is more useful to the animator.

- (iv) **Tracking Live Action:** This technique produces exceptionally realistic motion. Trajectories of objects to be animated can be generated by tracking of live action. One such method is *rotoscoping*. A film is made in which people or animals act out the parts of the characters in animation. Then the animator draws over the film, changing the background and replacing the human or animal actors with their animation equivalents. In an alternative method some sort of indicators or