UNIT 7  MULTIMEDIA

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7.0 OBJECTIVES

After going through this Unit, you should be able to:

- define a multimedia system and its characteristics;
- discuss the various types of media associated with the multimedia systems;
- differentiate between multimedia and print media;
- describe various storage techniques, access media and formats;
- suggest various s/w and h/w requirements for a Multimedia System; and
- discuss security, copyright and other issues pertaining to the Multimedia Systems.

7.1 INTRODUCTION

With the advent of multimedia, the computer has evolved into a distinctive medium that is uniquely capable of juxtaposing text, images, audio, and video. Multimedia permits an extraordinary flexibility in conveying concepts – through words, pictures, and sounds, as something that can be built or played as well as read or watched. New genres, such as simulation games, are emerging that challenge the user or player to build some complex creation – a city, species, business, or world- out of some given set of resources, or that put the person into a simulated environment or through a scenario to meet a challenge or learn a skill. The computer thereby turns the passive reader into a participant; it cues the person of a need to do something, but not necessarily what to do. With multimedia the computer draws on more of the senses, and more dimensions of intelligence, enlarging the opportunity to learn for those who have been less able to learn from conventional teaching materials. Some uses of the new media are genuinely inspired, provocative, and engaging, and these examples suggest that multimedia have opened an important new chapter in the history of the imagination.

7.2 MULTIMEDIA

A multimedia system is a system which combines different types of media such as text, web pages, hyperlinks, audio, video and graphics. The use of multimedia gives the user a more full experience than a single media such as text. The result of a multimedia system will include some kind of multimedia presentation.

Multimedia systems are information systems that combine a variety of different media types, including text, hypertext, audio, images and video. Professional multimedia systems, especially at the time of creation, involve many participants with a wide breadth of experience.

The creation of multimedia systems encompasses each of the information processes.

Multimedia primarily focus’ on the information process of displaying, however, it also investigates a number of the other elements involved, including processing, organising, storing and retrieving and collecting.

7.3 CHARACTERISTICS OF MULTIMEDIA SYSTEMS

Multimedia consists of information presented in various forms, including text, numerical, audio etc.. It will often include some kind of hypermedia. The hypermedia may contain clickable links or may be disguised as a menu such as at the start of a DVD.

Multimedia is the use of several different media to convey information (text, audio,
Middleware Technologies

Multimedia refers to computer data storage devices, especially those used to store multimedia content.

As the information is presented in various formats, multimedia enhances user experience and makes it easier and faster to grasp information. Presenting information in various formats is nothing new, but multimedia generally implies presenting information in various digital formats. It is also used in visual arts to describe works created using more than one medium.

Multimedia finds its application in various areas including, but not limited to, art, education, entertainment, engineering, medicine, mathematics, and scientific research. In education, multimedia is used to produce computer-based training courses (popularly called CBTs) and reference books like encyclopaedia 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.

Self-Check Exercise

Note:  i) Write your answers in the space given below.
     ii) Check your answers with the answers given at the end of this Unit.

1) Define Multimedia and Multimedia Application.

7.3.1 Types of Media

The following are the main types of media:

**Text** refers to any typed material. Text includes numbers and characters whose meaning must be read to gain meaning. It may be typed in through a word processor but is also often typed into the multimedia software.

**Numbers:** Numerals which allow calculations. Includes currency

**Hypertext** is a term created by Ted Nelson to describe non-linear writing in which you follow linked paths through a world of textual documents. The most common use of hypertext is found in the links on World Wide Web pages.

**Audio:** Sound which has been digitised.

**Images (Graphics)**

Images are pictures, graphic elements which are displayed on the screen. They maybe of two types:

**Bit-mapped graphics** (also known as raster images): A bit-mapped image is one composed of pixels. This means that there is a relationship between the graphic on the screen and the bits in memory. Bit-mapped images can also be called raster images and would normally be composed in a paint program.

Bitmap images come from paint style programs and are the format used for digital photos. Bitmap images can be very large but can be compressed down to a small file.
size. Bitmaps pixelate when they are enlarged. **Pixelation** refers to that block and grainy look that photos and images get when they are enlarged too much. Jpegs are one example of raster images.

**Vector graphics:** These are made of objects such as straight lines, curves or shapes. It is created through a mathematical formula.

**Animation:** Animation begins with still images which are then given the illusion of movement is the movement of a graphic. It is the result of making a sequence of drawing called frames and showing them rapidly one after another. Animation maybe cel (also called cell) based or path based

**Video:** Video combines pictures and sound displayed over time. It is important to know that here are differences between an animation and a video. An animation begins with a still images which is then given the illusion of movement but a video records a continuous event such as a rock concert where movement and sound are of course a natural part of life; and very much so at a rock concert where a person’s eardrums may be moving as much as anyone on stage.

Images have proven a very powerful means of communicating messages, and can evoke a strong response from the user or viewer. However, video, like sound, is very processor and memory hungry. It also requires special hardware and software to enable it to be recorded and, to a lesser extent, played back.

Piped/ streamed video is an effective method of displaying video footage on a computer screen. It involves a suitable video card to receive and translate the video data into a form that can be displayed on the screen. However, the computer has no control over the displayed signal.

**Self-Check Exercise**

**Note:**

i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

2) List the various types of media commonly used with multimedia?

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7.3.2 **H/W Requirements for Multimedia Systems**

Multimedia technologies continue to develop, and are thus still in an evolutionary process. However below is an indication of what you would need to do some basic multimedia.

**RAM:** 1 GB minimum

**SPEED:** 1 GHz

**STORAGE:** Depending on the work your doing you may require anything from a 10GB available space upwards

The above specifications are only for minimal graphics work. If video editing or heavy graphics is required than you will need to at least double the minimal RAM and speed.
of the processor. The amount of RAM, ROM and hard drive space that a computer can utilise is a limiting factor in its multimedia capabilities. This is due to the high storage requirements demanded by high quality images and sound files.

### 7.3.3 Components of a Multimedia System

Consider the Components (Hardware and Software) required for a multimedia system:

- **Capture devices** – Video Camera, Video Recorder, Audio, Microphone, Keyboards, mouse, graphics tablets, 3D input devices, tactile sensors, VR devices. Digitising Hardware
- **Storage Devices** – Hard disks, CD-ROMs, DVD-ROM, etc
- **Communication Networks** — Local Networks, Intranets, Internet, Multimedia or other special high speed networks.
- **Computer Systems** – Multimedia Desktop machines, Workstations, MPEG/VIDEO/DSP Hardware
- **Display Devices** – CD-quality speakers, HDTV, SVGA, Hi-Res monitors, Colour printers etc.

### 7.3.4 Key Issues for Multimedia Systems

Some of the key issues multimedia systems need to deal are:

- How to represent and store temporal information?
- How to strictly maintain the temporal relationships on playback/retrieval?
- What processes are involved in the above Data has to represented digitally – Analog–Digital Conversion, Sampling etc
- Large Data Requirements – bandwidth, storage, data compression is usually mandatory.

### 7.3.5 Desirable Features for a Multimedia System

Given the above challenges the following feature a desirable for a Multimedia System:

- **Very High Processing Power** – needed to deal with large data processing and real time delivery of media.
- **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 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. Need to allow for real-time recording as well as playback of data.
  - for example, Direct to Disk recording systems.
- **Special Operating System** – to allow access to file system and process data efficiently and quickly. Need to support direct transfers to disk, real-time scheduling, and fast interrupt processing, I/O streaming etc.
● **Storage and Memory** – large storage units (of the order of hundreds of Tb if not more) and large memory (several GB or more). Large Caches also required and high speed buses 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.

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### 7.4 PRINT VS MULTIMEDIA

There are large differences between print and multimedia and advantages and disadvantages associated with both.

**The Mode of Display**

Print media is limited to hard copy such as books, newspapers, magazines and posters while multimedia addresses a number of senses and can be used on computers, mobile phones, PC/TV combinations and a host of other diverse applications.

**The Interactive Nature of Multimedia**

Interactivity means that the user is able to make an immediate response to what is happening and modify the processes. This means that multimedia is more than just a one way communication. Effectively, there is communication between the user and the application.

**The Dynamic Nature of Multimedia**

Once a book is published it cannot change, it is static. An interactive multimedia product can change depending on actions taken by both the author and the user. The multimedia author can easily and cheaply change the multimedia presentation whereas this is an expensive exercise for the traditional author. ‘Smart’ products can change the way they work based on characteristics the program ‘learns’ about the user.

**Data Structure**

Computers give us many different ways of accessing data and multimedia systems need to be structured so the user can easily find the required data. Structures include: A hierarchical structure or it can be sorted into an order such as alphabetical.

**Indexing**

We are familiar with the indexes provided in many reference books but these indexes are always very selective. An interactive multimedia product can index every occurrence of every word.

**Ease of Distribution**

Unlike print media which requires printing presses, ink, paper, a willing publisher, distribution networks in stores, advertising to sell, sales staff to sell the book and a whole lot of money to cover all of these costs multimedia just requires a computer, a person to create the material and a distribution media whether that be over the internet, disc or a combination. Clearly it is much simpler and cheaper to produce most multimedia then it is to produce books. However it would be simplistic to say that it is always easier. Movies such as Avatar are multimedia productions which require far more expenditure than any book and probably far more staff, but this is a particular example.
Authority of Document

Books are often granted more authority than a website. A website may have very little checking and editing by a third party whereas most books will have many people who read through the manuscripts and check sources. However this is not always the case. There have been many books published which have very doubtful facts and authority.

7.5 MAJOR AREAS OF MULTIMEDIA USE

Multimedia systems may be designed for a mass audience or for a specific target audience. Major areas include: education, leisure and entertainment information. It is possible to combine a number of these areas into one application. Educational games, or edutainment software, for example, consist of programs that look like games but are designed to teach in an entertaining manner. Each of the above examples deals with the presentation of information in a variety of forms. The significant advantage of multimedia is its interactive nature, which gives control to the participant, rather than the designer.

The variety of presentation methods makes multimedia a useful tool across all the age groups. Multimedia removes the limitation of forcing everyone to move at the same pace by providing an interactive approach to learning with more advanced users moving ahead. Government and businesses also use interactive multimedia programs to train staff. This type of training is not constrained by time and can be programmed to meet individual needs.

The main uses of Multimedia are:

- Multimedia In Education and Training
- Leisure and Entertainment
- Information Kiosks
- Virtual Reality and Simulations

Multimedia in Education and Training

The “Reader Rabbit” series is an educational multimedia program which provides interactive assistance in developing reading skills. Participants include school students, teachers, parents and siblings. The direct users (students) control activities as they make choices from a menu.

Data includes text, images and video combined to produce structured activities.

The information technology required is a multimedia computer with a CD-Rom, sufficient RAM and processing speed.

Leisure and Entertainment

Electronic games, 3D adventure games, sporting games and interactive movies are extremely popular forms of multimedia applications. The key to their popularity lies in their interactive nature. The new generations of games provide ingenious levels of interactivity and realism to captivate the user of the product. The attraction of this type of application is realism, fast action and user input through peripherals such as mouse, track-pad, keyboard and joystick. Computer-based games have led to many developments in interactive computing. This type of application requires a high level of graphics computing power and hence the impetus to develop more efficient algorithms for display movement and more powerful graphics cards.
Information Kiosks

Multimedia has been successfully used to provide guidance through the use of information centres in locations such as museums, airports, shopping precincts and libraries.

An information centre or kiosk allows the user to search for specific information in his or her own language without the need to approach a stranger. Location details, product availability, arrivals and departures, opening and closing times and so on are all examples of information that can be presented in this format. Touch screens are often an integral part of an information centre because they reduce the technology literacy requirements normally associated with the use of computers.

Virtual Reality and Simulations

Virtual reality is a computer-generated artificial reality that projects a person into a sensation of three dimensional space. Virtual reality is becoming more popular in arcade type games such as Atlantis. You may have even tried to tee off on a virtual golf driving range or driven a virtual reality race car. A far more important use of virtual reality is a simulator. A simulator is a device that represents the behaviour of physical or abstract systems. Simulators are used very effectively in training applications for aeroplane pilots or bus drivers to help them deal with various real-life situations in a safe environment. The medical area has also seen increases in the application of simulation technology. For example, surgeons can rehearse a particular operation on a ‘digital’ patient, and some phobias, such as a fear of crowds, can be treated. One ethical issue for implementers of virtual reality equipment is how to keep users from suffering uncomfortable effects from using virtual reality systems. Known as cyber-sickness or simulator sickness, symptoms include eyestrain, nausea and confusion and even visual or audio flashback for some users.

Self-Check Exercise

Note:  i) Write your answers in the space given below.
      ii) Check your answers with the answers given at the end of this Unit.

3) List some of the applications of Multimedia?

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7.6 ADVANCES IN TECHNOLOGY

Technological advances have continued to influence the development of multimedia including: accessibility, communication speeds, compression rates, CDROM, DVD and firewire technologies. Ease of access to the Internet and World Wide Web has made it very easy for large numbers of people to access multimedia systems stored as a series of linked web pages.

The main categories are as follows:

- Storage Capacity
  - Hard drives
Middleware Technologies

- CDROM
- DVD
- Firewire
- Internet Bandwidth

Storage Capacity

Multimedia is very memory hungry but with the explosion in memory storage capacity this is becoming less and less of an issue. However it is important to note that without the large increase in storage capacity multimedia would still be difficult to use.

Hard Drives

Hard drive storage capacity continues to explode. Hard drives are now measured in gigabytes with plans underway for terabyte drives.

CDROM

CD-Rom, which stands for compact disk-read only memory, is an optical disk format that is used to hold pre-recorded text, graphics and sound. In this type of disk the content is recorded during manufacture and then read many times by the purchaser. Initially, a CD-Rom drive was only a single speed drive, with the ability to access data at 150 kilobytes per second. Through improved technology it is now possible to purchase drives that are 40 or 60 times (40x, 60x) this speed. The faster the drive spins, the more quickly it is able to deliver information to the processor. Each CD-Rom disk can store up to 783 megabytes of information. The development of this technology effectively began the multimedia revolution due to the sudden availability of high capacity random access data storage.

DVD

DVD (digital versatile disk) is an optical disk technology that is expected to rapidly replace the CD-Rom disk (as well as the audio compact disc) over the next few years. Increased storage means increased flexibility for multimedia developers. A DVD holds 4.7 gigabyte of information on one of its two sides, or enough for a 133-minute movie. With two layers on each of its two sides, it can hold up to 17 gigabytes of video, audio, or other information. Compared to the current CD-Rom disk of the same physical size, holding 700 megabytes, this is more than 28 times as much information!

Firewire

FireWire is essentially a new way to connect different pieces of equipment, such as digital videos and hard drives, so they can share information rapidly and easily. Originally created by Apple, and standardised in 1995 as the specification IEEE-1394, it is a technology that:

- allows fast transfer of data (up to 400 Mbps);
- allows many devices to be connected simultaneously on the bus network;
- is hot pluggable;
- provides power through the cable;
- allows plug and play;
- has low cabling costs;
● has increased data transfer rates through the use of a fairly inexpensive option.;
● This has expanded the possible applications of multimedia into more powerful and data intensive areas.

Internet Bandwidth

Improvement in communication speed (or bandwidth) through technologies such as cable, ADSL and satellite have made the presentation of multimedia content via the Internet a viable option increasing download speeds that used to frustrate many Internet users, particularly for pages that incorporate graphics, sound and video. Compression and animation technologies such as MP3, QuickTime, Flash, Shockwave, Java and JavaScript enhance the interactive nature of the World Wide Web.

7.7 MULTIMEDIA DESIGN

It is important when designing multimedia that all elements be in harmony and that images and graphics be optimised for fast and efficient use of bandwidth.

There are 3 aspects to optimisation:

● the basic coding of the page,
● scripts that are used on the page,
● images (large can have the most significant impact on load times).

Image Types

There are many image formats in use on web sites but the three most common are GIF, JPEG, and Flash content. Our focus is on GIF and JPEG.

The gif format only uses 8-bit colour (256 colours) but it is a ‘lossless’ format and so detail is not reduced. Gif images are the best way to render artwork such as line drawings, charts and maps, particularly if the number of colours can be reduced. However GIFs will give a larger file size if the picture has too many colours. For an image with a large number of colours a jpeg is preferable.

Jpeg images use 24-bit colour (16,777,216 colours) but the compression algorithm is loss. This means that resolution on a computer screen is lost on compression, this may not be noticeable but a hardcopy image would show the degradation. Jpeg images are used for photographs (screen but not good printed). A reasonable quality photo in jpeg is commonly around 20-30 Kb where the equivalent in gif could be 100-300 Kb. With jpeg files the quality required is set when the image is saved.

Each image format has strengths and weaknesses. GIF or Graphics Interchange Format was developed by CompuServe before the Internet days as a way to share images on the CompuServe bulletin boards. Due to limitations with screen resolutions and colour depths at the time, GIF images were only able to show 256 colours, more colours were imitated by Dithering, a process of tricking the eye into seeing one colour by using 2 or more sets of colour dots spaced closely together.

A chessboard with black and white squares becomes a grey blob when viewed from a distance even though close up we can see each black or white square. This is the concept behind dithering. Our eyes merge the black and white squares together. On a computer screen these black and white squares would be called pixels awhile the number of black and white squares would be called the resolution. The more squares the better
the definition of the image. Unfortunately if there are too many colours to be dithered 
the file size becomes very large.

The JPEG file format is newer and can handle up to 16 million colours. The initial 
problem is that JPEG images do contain many more colours, and each colour requires 
coding for display, possibly making larger file sizes. The compression rate of a JPEG is 
easily changed at the time it is saved. It is possible to get a good balance between 
resolution and compression rate. Lower compression rates will still give a quality print. 
As the compression rate increases the image on the screen will not seem to vary much 
but the print quality will degrade quickly as the compression rate is increased.

**Improving Load Times**

The main way to make an image load faster is to make the file size smaller. This can be 
accomplished by either:

- making the dimensions of the image smaller, or
- decrease the amount of coding that is required to display the image.

The easiest way to reduce an image’s file size is to reduce the image’s physical dimensions. 
Make the picture smaller. Smaller the image, smaller is the file size. If we reduce the 
image size by one half to 40 pixels by 40 pixels we then have 40x40 or 1600 pixels. So 
reducing the image size in half reduces the file size to one fourth of the original. The 
following are the principles to be followed for the Image file size reduction:

- Use the smallest image dimensions that will work with your layout. And likewise 
  the fewer images on the page, the fewer image pixels, therefore the smaller the 
  page size. GIF and JPEG image formats use different methods of saving image 
  information and so tend to be better at showing some types of images and worse 
  at showing others. GIF images, since they are limited to 256 colours per image, 
  are better at displaying images with large solid blocks of colour and images with 
  very small physical dimensions. The images look flatter and don’t have the depth 
  of colour of a JPEG. The GIF format will produce smaller file sizes than JPEG for 
  these types of images. JPEG images are better at showing gradients or subtle changes 
  from one colour to another. Therefore JPEGS reproduce photographs very well, 
  or any other image with gradations. This means that the JPEG format will produce 
  smaller file sizes for photo style images than the GIF format will.

- Choose the correct image format for the type of image you are using. Most web 
  pages will contain a combination of GIF and JPEG images. Decreasing the coding 
  is called image compression. Both GIF and JPEG images can be compressed but 
  the process is different. In GIF images we try to limit the number of colours, in a 
  JPEG image we use software algorithms to remove redundant information from 
  the file. Whenever we compress a file we will loose some image quality. We have 
  to reach a balance between a small file size and acceptable image quality.

- Find the least acceptable level of image quality. Most images can handle some 
  compression with very little quality loss, and all images can stand more image 
  quality loss and still be acceptable. You need to be able to decide how much 
  decline in image quality is acceptable, but remember the lower the quality the fast 
  the image load. GIF images can usually be reduced from 256 colours to 128 
  colours or less, the fewer colours used the smaller the file size. JPEG images can 
  almost always be reduced to a quality setting of 80% and frequently can be reduced 
  down to as little as 15-30%. So when you use a higher compression level (smaller
number) the file size will be reduced. Try smaller and smaller settings until you find the smallest setting that still displays an acceptable quality. The fastest loading page will have no images and the slowest loading page will be completely filled with high resolution images.

**Hardware in Multimedia Systems**

A variety of hardware is required to create and display the multimedia applications that are currently available including:

- **Display Devices**
  - Cathode Ray Tubes
  - Flat Panel
    - Touch Screens
  - Liquid Crystal Display (LCD) Screens
- **Projection Devices**
- **Speakers and sound**
- **MIDI**

**Display Devices**

Display devices, also called screens, monitors or CRTs, are output devices. Display screens are of two types:

**Cathode-ray tubes** (CRTs) produce an image by firing a beam of electrons onto the inside of a phosphorous coated glass screen.

**Flat panel** displays are made up of two plates of glass with a substance in between them that can be activated in different ways. Flat panel displays are distinguishable by either the substance between the plates (liquid crystal, electroluminescent material or gas plasma) or the arrangement of the transistors in the screen that control each pixel.

**Touch Screens**

A touch screen is sensitive to human touch. Used at information kiosks, computer based training, and by those having difficulty manipulating a mouse or keyboard. 3 types are: resistive, surface wave and capacitive.

**Resistive**: Coated with thin, metallic, electrically conductive and resistive layer. When touched a change in electrical current is registered as a touch event and sent to controller for processing.

**Surface wave**: Uses ultrasonic waves that pass over the screen. When touched, a portion of the wave is absorbed. This change in the ultrasonic waves registers the position of the touch event and is sent to controller for processing.

**Capacitive**: Coated with material that stores electrical charges. When touched, a small charge is drawn to point of contact. Circuits located at each corner of panel measure charge and send the information to the controller for processing. Capacitive touch screens must be touched with a finger.
### Middleware Technologies

#### Liquid Crystal Display (LCD) Screens

An LCD screen is an electro-optical device commonly used in digital watches, calculators, and portable computers.

- The LCD is a liquid crystal placed between a pair of transparent electrodes. Liquid crystal changes the phase of the light passing through it and can be controlled by voltage applied between electrodes. When placed between a pair of plane polariser plates then light can pass through only if the correct voltage is applied.
- LCDs are formed by integrating a number of such cells or by using a single liquid crystal plate and a pattern of electrodes. Electrodes in computer screens are in rows and columns. By applying voltage to a row and several columns the pixels at intersections are set.
- Putting a transistor, on top of each pixel, can slow fading. It will also ‘remember’ the setting of that pixel. These active matrix displays are as good as CRTs but much more expensive than passive matrix displays.

#### Projection Devices

A data projector is a device that allows the projection of video and graphic images onto a screen. Typically, projected images were best viewed in reduced light but the newer models are much brighter (1,000 lumens or more) and this has become unnecessary.

Three main types of technology are used to project images:

- **Three guns**: Separate guns for each of the red, blue and green colours are used to project light onto a screen. Although they produce the most light output they are also the most expensive.
- **Digital light projector (DLP)** technology uses a tiny multi-faceted semiconductor mirror chip to reflect light from a light source. The chip controls tiny semiconductor-based mirrors to produce an image that is sharper than the traditional LCD version.
- **LCD-based projectors** perform in a similar way to LCD screens where the light source is passed through an LCD before being projected onto a screen.

#### Speakers and Sound

Audio output is relatively straightforward - you just connect speakers or headphones to the sound card of the computer.

- Sound output devices are designed to convert binary data into information by producing digitised sound.
- To do this you need the necessary software driver and sound card and a digital audio circuit board such as a Sound Blaster.
- Sound cards generally plug into an expansion slot on the motherboard or come integrated with the mother-board on newer machines.
- Speakers provide the easiest and cheapest output device though it is often the quality of the sound file rather than the speakers that contribute most to the quality of the sound.

#### MIDI

MIDI, or musical instrument digital interface, is used to input or output analog musical
information from electronic musical instruments (known as synthesizers) in digital format ready for use by a computer. The information transmitted contains the note identification, time of play and the loudness, rather than the actual note itself. Midi files are very small compared to wav files.

Self-Check Exercise

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of this Unit.

4) State whether the following statements are true or false.

a) A computer capable of handling text, graphics, audio, animation and video is called multimedia computer.

b) MIDI data is digitised sound.

c) Animation can be used to emphasise the three-dimensional nature of objects.

d) Most commonly used format for graphics is .BMP or bitmap pictures.

e) If the sequence and timing of these multimedia elements can be controlled by the user, then one can name it as Non-Interactive Multimedia.

7.8 SOFTWARE IN MULTIMEDIA SYSTEMS

There is a range of software used for creating a multimedia product. The popular among them are:

- Presentation Documentation
- Multimedia Application Software
- Authoring software
- Animation software
- Web browsers and Editors

7.8.1 Presentation Documentation

Computer-generated presentations are quickly replacing the more traditional paper and slide-based approach. Presentation software uses graphics and data/information from other software tools to communicate and make presentations of data to others. Modern presentation software packages provide facilities to create presentations that may be viewed using: a standard monitor, a data projector for a large group, hard copies of slides and transparencies hard copies of paper handouts. This type of software, including packages such as Microsoft PowerPoint and Claris AppleWorks, can incorporate text, numbers, images, audio, animation and video, and allow relatively fast generation of a series of linked screens.

Presentation software creates several different types of documentation to help the presenter. These include:

On Screen Presentations

These are a series of slides which take the place of slide projectors as well as overhead projectors. They can be displayed on a monitor or projected onto a screen by way of
a data projector. The timing of the slides can be either manual from the click of a mouse or other peripheral or automatically timed.

**Overhead Transparencies**

The slides can be printed out onto overhead transparencies if required.

### 7.8.2 Multimedia Application Software

Application software is a computer program used for a specific task. Programs such as Microsoft Word, used to produce word processed documents, and Adobe Photoshop, used to generate complicated graphical images, can be used to generate content that can be incorporated into a multimedia project. A wide variety of specific software is available to generate and edit the various parts of a multimedia project such as video, sound grabs, images and animation. Some word processing software even allows the direct importation of video or sound.

### 7.8.3 Authoring Software

Multimedia authoring packages are designed to be relatively quick to use. These types of multimedia tools are called rapid application development tools or RAD tools. Authoring software allows the user to sequence and time the occurrence of events, determining which graphics, sound, text and video files are to be utilised at any given point in the final product. The software also allows the creator to determine the level of user interaction. Examples of this type of software include eXe, Courselab, Xerte, Macromedia Authorware, Macromedia Director etc. Authoring software is going to play an ever increasing role in education and training as employers and politicians increasingly look for low cost and more flexible solutions to their training needs.

### 7.8.4 Animation Software

There are many programs designed to create animations and to ease the burden of drawing the hundreds of cells or frames required for even a simple animation. Each has its own strengths and weaknesses but the majority provides the tools to produce an animation using one of the different animation techniques, including the traditional frame-by-frame, path-based, morphing or warping. Examples of animation software are Blender, Flash, Director, Image soft, 3D Max. There are countless others. However simple animations can be made simply and easily by using a GIF animator.

### 7.8.5 Web Browsers and Web Editors

Web browsers are used to look for information on the net while editors are used to create web pages. There are many web browsers but the most common two are Microsoft Internet Explorer and Netscape Navigator. Editors are used to create web pages and they range from text based such as Note pad and BBedit to WYSIWYG systems such as Dreamweaver and Frontpage. Pages on the WWW are written primarily in html (Hypertext Mark-up Language).

HTML files are plain text files and describe text formatting and are not a programming language as such. All html documents have the same structure with different codes, as the designer requires. Software that is WYSIWYG - what you see is what you get - implies that the contents of the screen are the same as the final printer or browser versions.
Self-Check Exercise

Note:  
i) Write your answers in the space given below.  
ii) Check your answers with the answers given at the end of this Unit.

5) What is the basic H/W and S/W required for creating a simple Multimedia Presentation?

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7.9 INFORMATION COLLECTION IN MULTIMEDIA SYSTEMS

Collecting information for a multimedia project generally requires the digitisation of data presented in another form and will include a range of activities including: writing the notes, digitising audio and video, editing and generally gathering information.

Digitisation of Analog Data

Audio, video and images are often represented in an analog format. To be used in a multimedia presentation they must first be converted to digital. An ADC or analog to digital converter is the tool used in this process.

Digital Text and Numbers

For use in a computer, data needs to be converted into binary numbers. This has been achieved for letters, numbers and other characters by the development of a number of coding methods. One common coding system is known as ASCII, which stands for American Standard Code for Information Interchange. ASCII is a 7-bit code that represents 128 letters, numbers and punctuation symbols as a 7-bit binary number. The eighth bit in the byte is used as an error checking parity bit. For example, the letter ‘e’ is converted to the binary number 1100101 using the ASCII code, which can be stored by the computer. Other coding systems exist which also translate characters into the digital equivalent. EBCDIC or Extended Binary Coded Decimal Interchange Code is used by IBM mainframes. This system uses an 8-bit code, and allows 256 different symbols.

Digitisation of Graphics

Digitisation of graphics refers to the process of putting images into a format that computers can read and store.

Bit mapping, or memory mapping, is the relation-ship between the image on screen and the bits stored in primary and/or secondary memory. One or more bits must be stored for each pixel (picture element) drawn in an image.

Each dot on the screen is known as a picture element or pixel. The more pixels that can be displayed by a screen, the better will be the image quality or resolution.

Pixel: At the simplest level, 1 pixel is represented by 1 bit, where 1 means on, or black, and 0 means off, or white. For example, a black and white graphic 640 by 400 would
contain 256,000 (640 x 400) pixels, and would require 256,000 bits to be stored in memory. That is, 32,000 (256,000 = 8) bytes of memory or 32.25 (32,000 = 1,024) Kb.

**Resolution** is normally quoted in terms of the number of horizontal pixels times the number of vertical pixels, for example, 800 times 600.

**Tones** (colours or greyscale) are a progressive series of shades from white to black, and are used in graphics to add contrast and detail. Such an image however, requires more memory because each pixel must be described by an increased number of bits. For example, 2 bits of memory per pixel (00, 01, 10, 11) would produce 4 (2^2) tonal colours, 3 bits per pixel would allow 8 (2^3) tones (000, 001, 010, 011, 100, 101, 110, 111) and so on.

The term **Bit Depth** refers to the number of bits that describe each pixel in the image. A 16-bit image would produce 65,536 (2^16) different colours or tones. It is obvious that the more detailed the image, in colour and tonality, the more memory would be required for its storage.

**Digitisation of Audio**

Sound and other analog data is generally represented as a transverse wave, and can be converted to digital form by a process called sampling. The two important aspects of sampling are sampling size and sampling rate.

**Sampling size** refers to the number of bits used to store each sample from the analog wave. For example, an 8-bit sample can represent 256 (2^8 = 256) possible levels in a particular sample.

A higher sample size will result in increased accuracy, but higher data storage requirements.

**Sampling Rate** refers to the number of samples or slices taken of the analog wave in 1 second. The higher the sampling size, the better will be the representation of the initial analog signal.

**Methods of Digitising/Capturing Video Images**

Capturing full motion video requires a video capture card to digitise the signal (unless using a digital video recorder, in which case it is already digitised) before storing on disk for later editing.

The standard PAL (phase alternate line) video signal used in India displays a frame rate of 25 frames per second. One frame of medium resolution and 16-bit colour requires approximately 1 Mb of storage space per frame. This translates to 25 Mb per second of video, or a staggering 1,500 Mb per minute.

Current personal computers cannot sustain a transfer rate between secondary and primary storage of 1,500 Mb per minute, so a number of solutions are applied including:

- Video data will be compressed during recording, using a codec.
- Decreased colour depth to fewer colours or even black and white shades requires significantly less memory.
- Decreased resolution reduces number of pixels to describe in each frame.
A storyboard is an illustrated scene-by-scene layout of the multimedia presentation. It generally includes text notes and sketches of the most important parts of the presentation.

The components of any multimedia production, be they text, hypertext, sound, video or graphics, have to be combined in such a way that the result is a blended product in which each element supports all others.

Different types of storyboards, as listed below, help achieve this:

**Linear – sequential**, movement through project.

**Hierarchical – top down approach**, which provides users with multiple choices at each stage of the project.
Non-linear – the user can choose the path of navigation through the project without significant restriction. There is no particular structure inherent in the design.

Composite - aspects of each of the previous three types are incorporated.

7.11 PROCESSING IN MULTIMEDIA SYSTEMS

Processing involves the modification of data in some way that makes it more useable. Processing in a multimedia system will include editing and compression. Some examples of processing include:
Multimedia consists of information presented in various forms, including text, numerical, audio and so the creation of this material occurs in an integrated environment using items from different sources, such as sound and video.

The integration of a range of forms of information leads to increased storage requirements. For example, a two hour movie contains so much sound and visual information that if stored without modification on a standard CD-Rom it would require over 300 disk changes during a single showing.

The solution to the storage dilemma comes from a mathematical process called compression. Compression is a method of removing redundant or repetitive elements from a file so that the file requires less storage space and thus less time to transmit. The algorithm that defines the process of compression and decompression is called a codec.

A concept that is often utilised in multimedia is called hypermedia. Hypermedia refers to the linking of data types. For example, clicking on a particular section of the screen may cause additional text to be displayed, or the user to ‘jump’ to a different section of the program. The term ‘hyper’ refers to a link between elements of the program, and so hypertext, for example, is text that is linked to other sections.

### 7.11.1 Image Processing

Image processing is another aspect of video work that demands processing power. There are two primary types that you need to be aware of:

**Morphing** is an image processing technique used for metamorphosis from one image to another. The idea is to get a sequence of intermediate images which when put together with the original images would represent the change from one image to the other. For example, changing a photo of yours into any another photo say, a tiger.

**Warping** refers to modification made to an existing image by stretching and resizing. In this case it is clear that you are still looking at the original image. For example, changing a picture of yours so that you have very large ears.

### 7.11.2 Animation Processing

Animation processing is required when presenting a series of graphics in rapid succession. The human eye experiences something called persistence of vision, and this is the principle upon which animation is based.

As one graphics frame is replaced by the next the screen is blank for approximately 500 milliseconds. However, the eye retains the last image until it is replaced and thus we see movement.

While all animation involves a series of images, there are several techniques that may be used:

**Cel-based animation** is a method of producing animation by the creation of a sequence of individual still images each produced on a separate cel. The term “cel” refers to an individual still image to be used in the animation sequence and comes from the more traditional hand-drawn images on separate sheets of celluloid, hence “cel”.

**Path-based Animation** is a method in which the starting point, end point and the path to be followed by an object are defined. The software generates the object, as it moves...
along the defined path, to represent the animation. Path-based animation involves displaying the movement of objects onto a fixed background.

The background pixels do not change, only those for the moving object. This saves memory and processing time. Animation is achieved by drawing the object, wiping it and the drawing the object in a new position. This process is made easier because animation software can create objects between two objects in key position.

### 7.12 STORING AND RETRIEVING IN MULTIMEDIA SYSTEMS

The concept of storage and retrieval is very important for any multimedia project because whether the mode is text, video, audio or graphic there are a wide variety of formats available. Each format will have advantages and disadvantages.

Not all formats will be supported by any program so that means that you must find a suitable format from the list of supported formats. Also not just any format will do the job. you must chose the right format for the right job. For example jpegs are a compressed graphic format. They have great colours but cannot be altered without losing data. If image needs to be altered then a different format should be used.

The different modes and their formats are as follows:

**Video:** av, mpeg, quicktime, real. The same as with other file types there are a large number of video formats. The main ones are av, mpeg, quick time, real player, flash and shockwave. mpegs are quickly becoming a standard. Mpegs are used on VCD (mpeg 1) and DVDs (mpeg 3 which is a higher resolution than mpeg 1).

- AVI (Audio Video Interleave)
- MPEG (Motion Pictures Expert Group)
- Quicktime Apple digital video, also available on PC

**Image:** jpg, eps, pict, tiff, bmp, gif: When choosing an image type two criteria are important: accessibility and file size. Below are formats:

- JPG (Joint Photographics Experts Group) A lossy compression format designed to reduce the size of full colour bit maps.
- EPS (Encapsulated Postscript) Uses vector graphics and often will only be interpreted by a printer. Therefore it cannot be displayed on screen.
- PICT Apple graphics format that is bit mapped or vector.
- TIFF (Tagged Image File Format) A bit mapped format, standard choice for scanned images.
- BMP (Bit Map) An uncompressed bit mapped format (Native to PCs).
- GIF (Graphics Interchange Format) Bit mapped format that uses a lossless compression algorithm. Limit of 256 colours.

**Text and numbers:** txt, doc, pdf, html, rtf: There are not a large number of text formats. Below are the main ones:

- TXT ASCII text (only ASCII characters) or delimited text exported from a database
- DOC Microsoft Word file
- **PDF (Portable Document Format)** Proprietary digital format produced by Adobe which preserves format and look of text document.

- **HTML** - (Hypertext Mark-up Language) Text based language which a web browser uses to render text, images, audio and video.

- **RTF (Rich Text Format)** Used to produce a document that can be read by other word processors.

**Audio:** *Wav, midi, mp3*. There are a wide range of audio formats. Below are three common ones.

Wav (wave file): digitised audio file of varying levels of quality which can be played directly by a sound card. This is a native PC sound file.

MIDI: (musical instrument digital interface) stores note information rather than sound which results in a small in a field size. However, it requires a synthesizer to replay.

MP3: Derived from audio layer 3 in a MPEG video. Currently requires a software player.

**Compression and Decompression**

These days compression of data is not only handy but is crucial to multimedia performance. In the following pages we are going to examine the various aspects of compression and decompression. Some of the important terms for this work are the following: compression, decompression, sip, archive, tar, mpeg, video compression, image compression, lossless, lossy, decompression, codec, coding redundancy, spatial redundancy, temporal redundancy, psycho visual redundancy.

**Video Compression**

Video compression is achieved by the use of a codec. A codec is a compression/decompression algorithm. A number of video codecs are in use, including Indeo (created by Intel) and MPEG-1, 2, 3, 4 and 7, created by the Moving Pictures Expert Group.

**Image Compression**

Image compression involves minimising the size of a file without degrading the quality of the image to an unacceptable level. The reduction in file size allows more information to be stored in a given amount of disk or memory space. Smaller file size also reduces the time required for information to be sent over the Internet. Compression schemes can be:

*Lossless*, where the decompressed data is identical to the original data with nothing lost in the translation, or,

*Lossy*, where the decompressed data is slightly different from the original, hopefully in insignificant ways, though some data is sacrificed for the sake of compression.

**Decompression**

Decompression (expansion of a compressed file) is only possible if lossless compression has been utilised. It is only possible to expand a compressed file format to the original data set if the compression algorithm does not discard information in the original compression process. Compression strategies can take advantage of four kinds of redundancy:
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- Coding redundancy, which relies on the fact that not all data will occur with the same probability.
- Spatial redundancy, which occurs because pixels that are near each other are likely to be similar to each other.
- Temporal redundancy, which occurs because pixels in consecutive frames of a video are likely to be similar, for example a “talking head”.
- Psycho visual redundancy, which occurs because the human visual system is better at detecting changes in luminance (brightness) than chrominance (colour).

Image Format Choice

Web graphics are very different to printed graphics. They must have a small file size and may be interactive. Web graphics require to use RGB (red green blue) colour scheme designed for monitors while a print media requires CMYK. Common web formats are:

- GIF
- JPEG (also called jpg)
- PNG

Images in other formats can be very large and need to optimise for the web and changed into one of these formats.

As such it is important to consider the most appropriate compression technique to utilise when preparing an image for the World Wide Web or any other multimedia project. Consider the criteria like:

- The gif format only uses 8-bit colour (256 colours) but it’s a ‘lossless’ format and thus detail is not reduced. Gif images are the best way to render artwork such as line drawings, charts and maps, particularly if the number of colours can be reduced. However GIFs will give a larger file size if the picture has too many colours. For an image with a large number of colours a jpeg is preferable.
- Jpeg images use 24-bit colour (16,777,216 colours) but the compression algorithm is lossy. This means that resolution on a computer screen is lost on compression, this may not be noticeable but a hardcopy image would show the degradation. Jpeg images are used for photographs (screen but not good printed). A reasonable quality photo in jpeg is commonly around 20-30 Kb where the equivalent in gif could be 100-300 Kb. With jpeg files the quality required is set when the image is saved.

7.13 ISSUES RELATED TO MULTIMEDIA SYSTEMS

There are many issues that have arisen from the development of multimedia. Some of them are to do with the violent nature of some content and the appropriate use of the internet but many of the issues stem from other areas such as copyright, the way technology has moved ahead so quickly and the general impact of those issues upon the individual and society. Lastly individual rights must also be protected along with those of companies and this is covered by concerns over data integrity (how accurate is the data that we are being fed. Is it accurate? Is it honest? Has there been a corruption of the data in any way.
The following are the important issues to be considered while developing the Multimedia Systems:

- Copyright
- Appropriate Use of The Internet
- Merging Technologies
- Data Integrity

### 7.13.1 Copyright and Multimedia Systems

Under the Copyright Act it is illegal to reproduce a literary work or to make an adaptation of that work without the permission of the author. “Literary work” includes software:

- The author or producer has the right to expect payment for their work. Time and effort are worth money.

- Computer programs are a particular problem because they are relatively easy to copy and modify. This becomes an ethical issue for users who have the technology to break copyright and avoid detection.

- If a multimedia developer does not acknowledge where images and sound files come from then they are breaking copyright.

- Shareware allows a user to try the software before buying. But shareware is not freeware and if you continue to use the software after the allowable trial period is over then you are breaking copyright.

**Software licensing**

There are a number of different license formats as listed below:

- **Single user** - the price allows the use of one copy of the software on one computer.

- **Site license** - the price allows the use of the software on a specified number of computers.

- **Freeware** - software may be used freely and copied for other users

- **Shareware** - software may be trailed for a period of time before a licensing fee is paid for a single or site license.

### 7.13.2 Appropriate Use of the Internet and Multimedia Systems

Appropriate levels of usage of Internet and other content involve the concepts of ethics and moral behaviour. Ethical issues relate to questions of morals. Is it right or wrong to proceed with a specific action? If you behave ethically or morally then you are behaving in a manner that most people would regard as the right way to act. Correct ethical or moral behaviour would normally reflect the norms of society. It is important to understand that norms change. Many people may feel that what was considered unethical behaviour 30 years ago is normal in current times. Widespread access to the Internet keeps the issue of ethical and moral issues active. People are being exposed to all sorts of material. Who should have access to different material? How much censorship should be imposed on the Internet? How much censorship is possible?
7.13.3 Merging Technologies and Multimedia Systems

The lines dividing computers, telephones, radio, television, voice and data are blurring. This merging of content is called “digital convergence” which is where content can be stored as a digital file rather than the more traditional analog form:

- It is possible to use the Internet for telephony using a PC with a sound card, microphone and a standard Internet connection.
- Desktop radio broadcasting is also available on the Internet. Sites such as Real Audio’s www.real.com provide a compressed sound source that can be downloaded and played in real-time. Television has also made it to the Internet with WebTV. However, bandwidth limitations produce a poor quality picture.
- Audio and video files are available in two forms, downloadable files or live content called streaming audio or video. Streaming audio or video allows you to listen to or view the sound/ video while it is being downloaded.

7.14 DATA INTEGRITY IN MULTIMEDIA SYSTEMS

Data integrity means that the data is accurate, consistent, and up-to-date. As the amount of information available on the Internet increases, the issue of data integrity becomes more important. Multimedia systems used by educational institutions must use a data source that has integrity.

The reliability of material is not always easy to establish. There are many unreliable sources of information on the web. It is important that only reliable sources be quoted and used for research.

The publishers of the Encyclopedia Britannica could choose to use data from questionable sources but do not, instead preferring to spend the necessary time on research to ensure the integrity of their product.

It is important that those researching material on the web ensure that all source data is cross-referenced to ensure its accuracy.

7.15 CAREER PATH IN MULTIMEDIA

**Business:** Multimedia designers can be used in business application in a variety of ways like presentations, training, marketing, advertising, product demos, databases, catalogues and networked communications. They can be successfully engaged in video conferencing also.

**Advertising:** Imaginative and attractive advertisements can be made with the combination of text, pictures, audio and video. Multimedia designers have a big role in creation of advertisements. A product is well received by a customer if it is supported by a good multimedia advertisement campaign.

**Gaming and Graphic Design:** They are perhaps making the maximum use of multimedia. No computer game is complete without elaborate computer graphics, be it a arcade game, strategy based game or sports game. A computer game with good graphics is more enticing to play then a game with less or bad graphics. Multimedia designers have a great role in making a game successful.

**Product Design:** Multimedia can be used effectively for designing a product. First its prototype can be made before actually making the product. Multimedia programmers can be employed in this work.
**Education and Training:** It is perhaps the need of the hour requirement for the multimedia. Topics which are difficult to understand by reading the text can be made simple with the help of multimedia. Time is coming when the multimedia lessons will take place of classroom teaching. Students can repeat a lesson as many times until he understands the concept. Multimedia designers have big role in all this work.

**Leisure:** Multimedia can also be used for entertainment. Most of the cartoon films are made with the help of multimedia. It is used in scientific movies to give special effects like animation, morphing etc. Actors created by combining different frames with the help of multimedia can replace the actual actors.

With this Multimedia, students will gain creative skills and technological knowledge leading to many exciting career opportunities including in the fields of electronic publishing, web design, information architecture, human-computer interface, design, multimedia design and production, 3-D animation, computer games, exhibition design, scientific and medical visualisation and special effects for film and television. Escalating demand for these skills by the Creative Industries provide students with exciting options for professional placement and eventual employment nationally and internationally.

### 7.16 SUMMARY

Multimedia is the media that uses multiple forms of information content and information processing (e.g. text, audio, graphics, animation, video, interactivity) to inform or entertain the user. Multimedia also refers to the use of electronic media to store and experience multimedia content. Multimedia is similar to traditional mixed media in fine art, but with a broader scope. The term “rich media” is synonymous for interactive multimedia.

Multimedia may be broadly divided into linear and non-linear categories. Linear active content progresses without any navigation control for the viewer such as a cinema presentation. Non-linear content offers user interactivity to control progress as used with a computer game or used in self-paced computer based training. Non-linear content is also known as hypermedia content.

Audio is an important component of multimedia which can be used to provide liveliness to a multimedia presentation. MIDI is Musical Instrument Digital Interface. MIDI is a communication standard developed for electronic musical instruments and computers. A digital image is represented by a matrix of numeric values each representing a quantised intensity value. A bitmap is a simple information matrix describing the individual dots that are the smallest elements of resolution on a computer screen or other display or printing device.

Animation is created from drawn pictures and video is created using real time Visuals. Animation is possible because of a biological phenomenon known as **persistence of vision**. The different techniques used in animation are cel animation, and morphing.

### 7.17 ANSWERS TO SELF CHECK EXERCISES

1) **Multimedia** is the field concerned with the computer-controlled integration of text, graphics, drawings, still and moving images (Video), animation, audio, and any other media where every type of information can be represented, stored, transmitted and processed digitally.

A **Multimedia Application** is an Application which uses a collection of multiple
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media sources e.g. text, graphics, images, sound/audio, animation, movie clips, and/or video.

2) Text, graphics, images, audio, video, animation etc.

3) Some of the major applications of Multimedia are:
   a) To create Computer Based Training.
   b) To create interactive web contents with sound and movie files.
   c) To create Multimedia presentation for marketing and promotional aids.
   d) To create informative Kiosk etc.,

4) (a) True (b) False (c) True (d) True (e) False

5) A high end PC/ workstation with a reasonable VRAM, RAM and CD-ROM Drive and Speakers as for as Hardware is concerned. The basic required configuration is: RAM- 1 GB minimum, SPEED-1 GHz, STORAGE- Depending on the work your doing you may require anything from a 10GB available space upwards. For the software any image editing software like Adobe PhotoShop, animation software like 3D Max or Blender, some sound editing software like Sound Forge or Audacity and lastly Authoring software like Macromedia Director.

7.18 KEYWORDS

FireWire          : A standard high-performance serial bus for connecting digital devices together or to a computer.

Hypermedia       : An extension to hypertext providing multimedia facilities, such as those handling sound and video.

Hypertext         : A software system allowing extensive cross-referencing between related sections of text and associated graphic material.

Pixel             : Abbreviation of picture element refers to a minute area of illumination on a display screen, one of many from which an image is composed.

Raster graphics   : A dot matrix data structure representing a generally rectangular grid of pixels, or points of colour, viewable via a monitor, paper, or other display medium.

Vector graphics   : Use of geometrical primitives such as points, lines, curves, and shapes or polygons—all of which are based on mathematical expressions—to represent images in computer graphics.

7.19 REFERENCES AND FURTHER READINGS


