feedback and minimising the users' mental loads are the most important considerations in defining software user interfaces Good software design should take into account the kinds of people who use the program, *the* diversified user background, the complexity of use the need to use any other program and the consequences of human error.

2.7 SUMMARY

In this unit, you have been able to have a glimpse of who works at the other end of the computer—a human, and ease of use is a major aspect of systems design.

Whether it is input-output devices or the software interfaces, it is brought out that different people react differently. There is therefore no such thing as a single user friendly interface for all.

The relevance of ergonomics in office automation systems *has* also been drawn attention to, because this is the most common application of computers and affects a large number of persons.

Human-Computer Interaction is now a flourishing topic with interdisciplinary inputs and support from various industry quarters, as it is not perceived to be crucial to the effective use of computer based systems.

UNIT 3 INTRODUCTION TO MULTIMEDIA

Structure

3.0 INTRODUCTION

Multimedia is a new technology born, in Lhis world of ever changing and demanding technology and diversifying world of computer. Since last few years, it seems lo be much sought after and talked about, not only in the world of Information Technology, but also in various functional fields like advertisement, corporate sector, cinema, fashion design and education, to name a few. More and more research work on Lhis new technology of sound, animation and text, is making it better and better with every passing day. It is one of the most realistic way of working even for a computer literates, where it targets people from almost all ages of life from a toddler to a aged one. In fact it docs not have any upper limit for its target audience.

3.1 OBJECTIVES

At the end of this session, you would be able to

- undersfand the basic concept of multimedia
- appreciate multimedia as a new chapter in information technology
- identify and describe various components of multimedia like, sound, animation and graphics
- understand various hardware and software for multimedia
- describe how images and sound works in multimedia.

3.2 MULTIMEDIA - THE CONCEPT

You can call it by any name, multimedia, intellimedia, hypermedia or newmedia. In its simplest scnsc, multimedia means the combination of the text, sound, and graphics. But no body is sure, whether it is a computer itself or a computer software product. In practical sense it is the combination of both. And the fact remains is that it has the best potential to be

one of the most powerful form of communicating ideas, searching for information and experiencing new concept of common media ever developed. One might compare it with the conventional form of media which also uses sound, graphics and text like TV, audio etc. Every program you see in TV is a combination of all these. But all these media elements can not be attributed to multimedia, because they do not have the interactive feature. For example a multimedia version of news bulletin would be that where you can request the broadcaster the type of news you are interested in and when you want to hear it. And with a press of a button or a click on mouse you can hear the news.

Non-availability of a wide range of multimedia products in the market might be one of the strong reason that it remains a mystery to the general public. But if you think a bit seriously, you can see one way or the other, multimedia has started creeping into our day to day life in various form, and information has started becoming available; in the digital format. And when the information is stored in the digital format you have lot of flexibility in handling it. It can be edited according to specific requirement and produced in various style and taste.

Use of multimedia in various application can be justified by the levels of the user friendliness, it provides to its user with its interactivity and customization. Multimedia is widely used now a days in various applications and business is one of them. As the market competition is increasing with the introduction of better products in the market everyday, it has become absolutely necessary to provide better service and timely information to your client in a brief, precise and more understandable manner in a short time. It provides various ways to maintain a competitive edge for a company specially in training, market speculation and trend and public relation. The interactive feature of multimedia, brings life back to the business presentations, where one can present various aspects of a business such as, marketing plan for a new product, its impact in the market, consumer reaction etc. simultaneously or even you can combine all these to make the assessment of the consumer feedback on the product launching. The information which is digitised in multimedia makes it more assessable as compared to the conventional way of presentation using video, chart etc. where you cannot edit or modify whatever already video taped. Even if you do it, the cost involved will be high. Now a days many business organizations have already started creating powerful databases that can store and distribute digital media as easily as text.

Another critical application of multimedia is educational sector. It enhances the education quality with its theory of naturalist. It provides new way for teacher to encourage one of the most rare and important element of learning i.e. curiosity to know and explore. Topics can be linked with other related information as possible with graphics, text and sound (may be a lecture session from the subject teacher and so on). With a large screen projector and a multimedia playback system, teachers can use multimedia as a way to enhance their standard lesson plan and stimulate questions. On the other hand students will be able to further explore the topics using standard multimedia platform. And the assignment which requires students to make their own interpretation of the fact, as represented in the multimedia topics. There are several application possible in the area of education using multimedia. To fully explore the use of the information technology in education, definitely the use of multimedia in education would go a long way.

In a complete sense graphics, text and sound is the essence of multimedia and it provides the user friendly environment with most flexible interactive facilities.

3.3 MULTIMEDIA – DESIGN, PRODUCTION AND DISTRIBUTION

All the developmental works based on three basic principles; planning and design, production and distribution or the final product, so also multimedia.

Planning/Design → Production → Distribution

3.3.1 Planning/Design of Multimedia

During the initial design phase all the aspects of the related multimedia project is carefully thought about and planned well before the production started. Every key element involved is discussed. There are various tools available to plan the project. A flowchart is one of them. It is one of the most commonly used tool to prepare a blue print of the planning, organizing everything during the design phase. It shows how all the elements involved in the project are

an

related to each othe : with adequate information about their controlling features.

Like any other video program or movie, multimedia programs requires a script on the subject involved in the project Io work on and to keep track of the elements in the show. The script and flowcharl works togclhcr to provide a prirted version of text, graphics and sound used in the production of the multimedia program.

3.3.2 Production of Multimedia

The process of creating the related mcdia elements in a multimedia project including graphics, sound, animation and digital video is called production. In multimedia all these creation of mcdia elements, can even bc independent in terms of tools used to producc them. For example graphics elements arc created independently using various computer graphics packagc such as paintbrush, 3D studio etc. These arc created and modified accordingly so as to work under various multimedia platform. All the sccnc of the project is digitised and edited into various sequence and when lhe digitised video sequence has all the required scenes, titles and transition from one scene to another, they are compressed as to playback in the required speed and pre-defined sequence. Similarly sound and music effects relevant to the project, and digitiscd sccnc sequences arc created using digital recording system and MIDI (Musical Inslrumcnl Design Interface) equipment in a music studio, edited and recorded in the computer as a digital audio file. All textual matter in project are edited and convcrtcd into ASCII format and then modifies latter on and placed in the appropriate location within the scene scqucnccs.

One of the most important production task in a multimedia project is regular checking of all the scqucnccs. And this is very truc in case of creating a multimedia program for CD-ROM, because a CD-ROM can only transfer data Io and from computer at a fraction of spccd of a regular hard disk drive.

Once all the related media elements arc created and digitised according to the specifications, then comes the final stage of the production process i.c. joining or combining these media elements which is also known as authoring. This process is used to join all the independent mcdia elements such as graphics, text, animation and sound to produce an interactive Iramcwork. And all the testing and debugging of the entire packagc is done at the stage before putting them into various distribution media.

The first step of authoring is to bring all the independent media elements used in the multimedia project, as each of them arc developed using various graphics, audio, video and animation tools.

Oncc all graphics, text, animation and digital vitlco arc combined together, different relationship and actions for each of lhc media element can bc worked out by adding interactive control. When multimedia program is executed, the interpreter part of the authoring program takes all necessary commands and relationship that has been defined for each mcdia elements and convert them into binary code or machine code that computer operating system can understand. The convcrtcd program is then executed by the CPU of the computer system, which send out instructions to the system to play the music or any audio, display all the text, video and animation and also execute any external commands is defined.

3.3.3 Distribution of Multimedia

Once all the mcdia elements are combined together using authoring software they are bundled into packagc and stored in various storage media for distribution. Creating multimedia packagc lor various platform is one of the most crucial stage that multimedia procedure face today. There arc many platform available for multimedia, each of which has their own advantages and disadvantages. To work with full potential, multimedia package need to bc available in as many platform as possible. Various storage media used to store multimeuia packagc arc CD-ROM, Interactive laser Disk etc.

3.4 COMPONENTS OF MULTIMEDIA

As already discussed, multimedia is a combination of sound, text and graphics, which are also the essence of the multimedia. Printed matter continuc lo bc the most common form of conventional way of putting the ideas and with the electronics publishing technology it is possible Io producc better printed material but they arc static and non-interactive in nature in

the sense that sound and motion can not be added to it to give it the interactive feature. But this is possible in multimedia where textual matter can he combined with motion and sound. All multimcdia disk contain some amount text, and even some might contain a large amount of textual matter, in various type of fonts and type size to suit the professional presentation of the multimedia software.

Another important and interesting components of multimedia is graphics. One of the very basic facts in multimedia production is that, people do not like reading large amount of textual matter on the screen. And also it is a fact about human nature that a subject is better explained to them when represented in pictorial or graphical form, instead of textual matter i.e. graphics are used more often than text to explain a concept, present background information etc.

Unlike text which is represent in universal ASCII format, graphics does not have any single agreed format. To start with there are two different ways in which graphs or images can be described, Bitmap and Vectors.

3.4.1 Bitmap Image

A bitmap image uses the pixel or dots on the screen to form itself and the size of such a image depends on the pixel density and number of colours it uses. For examples for a standard VGA screen uses 640 × 480 i.e. a total of 307200 dots or pixels to display an image. If your image is in black and white, then only one digital bit is required to store this information about the image for each dot (0 for black and 1 for white), and the position of the docs can be taken as the order in which they are produced. As a byte is consists of 8 bits, one can store a black and white image of this type in ((640 × 480)/8) = 38400 bytes = 37.5KB, so imagine the storage space required to store all the images involved in the multimedia production. If you are using color for the images then the size of the bitmap image becomes larger depending upon the number of color used. A standard VGA which uses 16 colors needs 4 bits of storage to store the information, so only two dots can be coded in a single byte. Hence ((640 x 480)/2)=153600 bytes of space is required lo store a single image with 16 colors. Similarly for a image with 256 colors (8 bits per dot), 32000 colors (16 bits per dot) or 16,000,000 colors (24 bit per dot) storage requirement will be very high. So a standard image with 16 colors will be ideal solution for a low cost multimedia package.

As discussed, bitmap images are stored as large files and you require large amount of disk space to deal with it. To avoid this constraint, the images can be compressed, which *make* the use of the fact that many entry in a bitmap file has repeated information or contain vcry little information. But there is no single standard compression method for image files. There are various formats such as PCX, TIF, BMP, GIF etc., in which images arc stored.

3.4.2 Vector Image

Other format for storing images is vector or object oriented format. In this format, an images is formed as a set of straight or curved lines instead of dots. A line can be represented by a mathematical equatiori, whose number can be stored as set of binary codes. Bccausc this form of coding is potentially more economical of disk storage space. The drawback is that it requires software is calculate the number to form the image anrl also it is vcry timc taking. CAD can be one example for this type of software. A vector image file is always of the same size no matter how large the image is. For visual clarity this type of image depends on the quality of the display media.

There are several technology and sources available to produce images or graphics for multimcdia package. Image can be created in Paint program, scan photographs using a scanner and hand drawn artwork, generate 3D graphics and animation using various sophisticated software. You can combined these images using images manipulation program which can combined many differenttypes of graphics files, to create new images.

3.4.3 Animation

Animation also plays as a vital part of the multimedia program. The dedicated hardware and software built into the system increases the animation specd. Like a movie, an animation is just a continuous series of still images that arc displayed in a sequence. There arc mainly two types of animation used in multimedia, namely 2D arid 3D animation. 2-D animation which also known as cell animation is the most common kind of animation, where flat images are drawn one frame at a timc, This process is vcry time consuming but result obtained is spectacular in nature. Computer animation has increase the efficient and result of

cell animation with introduction of wide ranges of color and speed. In 3-D animation a mathematical model of a **3-D** object is created to realistically portray with depth. Now it has become a common media element in film, video and multimedia packages. **A3-D** animation follows mainly three steps; modelling, animation and rendering. Of these three first two are crucial and take long time to finish. Modelling is the design phase where a 3-D object is created. In a **2-D** animation an object can moved 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 axis, color, shading and light source can be added to the image to make it more realistic.

In the second phase, the **3-D** images is moved along a motion path, which is defined using key frames of the animation sequence. These key frames are used to create the inbetween frames in the sequence automatically.

And in the final stage, the entire sequence in render to create a 3-D animation. Blending texture maps into the model to add realism causes one of the main slow downs during rendering. A texture map is a wallpaper for **3-D** models, in which a graphic image is wrapped over the surface of a model. When a 3-D animation program renders an images, it mix up intimately all the color. shade. texture maps, light source and surface attributes in each frame of the **3-D** animation sequence.

3.4.4 Morphing and Warping

Beside animation there are some special effects used in multimedia. Morphing and warping are two commonly used special effects. Morphing takes two images and seamlessly changes one images 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 one images is used to show various changes that take place. It uses the key points of one image to create different effects, instead of mixing up two images.

3.4.5 Digital Audio

Digitised audio is used as means for providing an interactive solution to the multimedia. The most common reason for using digital audio in computer is so as to be able to use multimedia in its full potential. The most common requirement is lo be able to input sound such as a spoken commentary on an image or a document.

As all of you know, sound is a repeated pattern of presswc in the air and a microphone converts a sound wave into an electrical wavc. The shape and frequency of the electrical wave is identical to the shape and wavc of the sound wavc and the clarity of what we hear is entirely depend on the shape and frequency of the sound wave. Sound can also be recorded and reproduced using digital signals and the errors can be reduce drastically in digital recording of the sound. As in case of the video, audio has to be converted into digital form to produce digital audio in order to use it in the multimedia. And the digital audio system will then reconvert the entire digitised audio into analog form, which can be heard on the speaker.

And this two way transformation of audio is known as analog-to-digital conversion. But the storage space required lor digital audio is huge, something around more than 1MB for one minute of audio. The entire process of digitisation is a simple process o l converting analog or electrical signal of audio to a computer data tile in the digital format. The microphone (which is normally used for recording) convert the voice into electrical signal or analog audio signal. Then the analog signal is passed into the audio input of a digital card or sound card (discussed latter in this unit). Once inside, the signal is fed into the analog-digital converter, which convert the analog audio signal to digital form and store it as a computer data file. Playing back a digital audio data file is just the reverse process of converting analog to digital. Once the digital audio file is send to the sound card for playback the file is channel through a converter and only the digitised version of the original file is converted into analog and put into the speaker. As constant or frequent conversion can reduce the sound quality, it is always advisable to keep all audio in digital fonnat while working on a multimedia program,

3.4.6 Digital Video

Digitised video is one of the many technologies used in the development of interactive multimedia. It is one of the way to play back and record video in multimedia program. It offers a wide range o l flexibility as compared to standard video signal. Unlike regular video.

quality of image would not degrade from copy to copy. As digital video is made up of a digital code and not an electrical analog signal, it contain the exact information as in the original. However the final output depends on how the video images converted to digital form during the development phase. Video come in from an external source either from TV or VCR or camera to the video digitiser card inside the system. Some systems use card which has dual function for both audio and video digitiser conversion. The process of converting analog video signal to digital format is called sampling. Using this process the converter card in the system converts or process the analog video signals into digital data streams so that these signals can be stored in the binary data structure format of 1s and Os. The size of the digital data file is then compressed to a considerable amount using some compression program. During this process the digitiser fuses the digital video into a digital movie format and save that all the section of the compressed movie format in the hard disk. Once the conversion and compression process is complete, the file can be played back on the computer screen. These digitised files can also be edited according to requirement using various video editing software.

3.5 SOFTWARE AND HARDWARE FOR MULTIMEDIA

By now it must have been clear to you that, sound, text animation and graphics are the integral part of a multimcdia software. To produce these media elements, there are various software available in the market, such as Paint Brush, Photo Finish, Animator, Photo Shop, 3D Studio, Corel Draw, Sound Blaster, Master Blaster ctc. Softwarearc also available in the market to combined these independently created media elements, such as IMAGINET Apple Hyper Card, Script X etc.

3.5.1 Software for Multimedia

Among various types of softwarc for creation of graphics, animation ctc. Designer, Corel Draw, Picture Publisher, Photo Magic, Animator pro etc. are most commonly used programs,

Designer is one of the professional rated drawing and graphics package for windows which is also available in OS/2 system. It is specially meant for graphic artists, technical illustrators and has a wide range of drawing tools and powerful text handling features. Similarly Photo Publisher is a professional photo retouching or image editing package designed to enable to retouch and cnhancc photos faster. It has powerful masking and retouching tools and more than 30 special effects and filters. It has an image browser, precise scanner, printer calibration, a stitching tool and over 50 ready to usc texture and image.

Similarly other multimcdia related software also works on the same type of working environment, but they have their own features to experiment upon.

3.5.2 Multimedia Extension in Windows

All these softwarc do not havc a standard platform. To provide all PC the same standard to multimedia, Microsoft developed multimcdia exlcnsion for Windows operating environment. This feature add several multimcdia capabilities to the Windows operating system, including Resource Interchange File Format (RIFF), a standard formal for multimedia data, including Bitmap graphics, animation, digital video and audio recording and playback facility for digital audio. It also include MIDI (Musical Instrument Digital Interface) files and MCI (Media Control Interface) to interface a work with external dcviccs such as CD-ROM, Sound card, laser disc players ctc. Most of the multimedia extension softwarc for windows works in the background. The utilities like MIDI mapper, sound recorder and media player arc the direct interface to the software sections within the multimedia extension for windows.

Most standard window graphics arc limited to 256 colors if it is not interfaced with any external custom software and graphics card. All external devices outside the multimedia extension for windows arc controlled by MCI for windows. The main interface to MCI is the media player which in turns control any external dcviccs such as CD-ROM, Video Player, Laser Disc Player etc. Whereas sound recorder utility provides facility to playback and record digital audio as .WAV files, directly into the PC with the external sound device such as sound card, It has the function like start, record, stop, play etc. using transport control. Similarly MIDI mapper makes sure that events that are specified in the MIDI file arc sent to Ihe correct MIDI instruments.

The video for windows is an external set of software works along with multimedia extension for Windows. It has the feature for video digitised recording, playback and editing capabilities to the multimedia extension for Windows. The videocap utility of this software is used to capture the video and audio clips using external hardware. The captured sequence can be viewed in a number of different sizes and sped and also different color palate can be created from individual frame. Once captured, the entire sequence can be edited frame by frame according to the requirement. Video for windows has four different types of editing features named as VidEdit, PalEdit, WavEdit and BitEdit. As the name suggests VidEdit is used to cut and paste captured video segments together, WavEdit is the feature work with the recorded digital audio and helps you to edit it. Where as PalEdit is the work with the color palates within the captured video to improve the color, BitEdit helps clean up the rough patches in the images. It also has the interface to the media control panel to control digital video files.

3.5.3 Hardware for Multimedia

A typical multimedia package usually consists of CD-ROM player, sound card such as Sound Blaster, Master Blaster and some times a microphone and a range of multimedia software. And probably with either a bulletin MIDI interface on the card as an add on utility.

3.5.4 Sound Card

Sound output from a computer has been a feature of machine usually used for sending warning error message or games. If better quality and capabilities for sound output or inputs are required, then there must be a device which can be added to the basic PC machine. This device is known as Sound Card which is added to the basic PC machine by inserting it in free slot. The most common reason for adding a sound card to a PC is so as to be able to use multimedia fully by recording and playing back the digital audio. While selecting an add on sound card, quality of sound from the loudspeaker has to be taken into consideration and the software provided with a sound card should be adequate enough to suit your requirement for handling sound effects in multimedia.

Normally a machine of type 386 or 486 or latter version is used for multimedia, with ample RAM memory usually 4MB or more, adequatc secondary storage space with high speed reading facilities. While installing a sound card one should keep in mind that the installation of sound card should not conflict with any other external devices installed in the computer system. Installation of sound card might require some default settings to be changed to make it compalible with the computer system.

Once all the setting arc done correctly, place the card in a free slot and check all the connected cables to ensure that all connections are fitted properly. After this task is over, run the designated installation softwarc to install the sound card i.e. to make necessary changes in the computer software settings.

The most common clement of softwarc is install program which install drivers to work with the sound card. In addition to adding drivers, the installation program modify the AUTOEXEC.BAT and CONFIG.SYS so as to active the sound card when the computer is switched on.

3.5.5 CD-ROM (Compact Disc Read Only Memory)

Multimedia uses digitised audio and video which not only takes huge amount of storage space, but lhcy also required high speed storage media, which can send large amount of data back and forth quickly to keep audio and vicico playing and recording smoothly. Because of this requirement most of multimedia pnckagcs uscs hard disk drive which offer high speed, high data throughout and plenty of storage spacc like 1GB or more. Sometimes, two or more hard disk drive arc used as an array to work together so that they act like a single hard drive.

However using a disk array of two or more disk for multimedia storage, can no doubt boost the processing speed for the multimedia element, but these a.e not durable in nature. Magnetic optical disk media offer large amour.: of storage in a durable package. **CD-ROM** is now widely used for multimedia storage as it has an amazing amount of flexibility and potential as a multimedia storage and distribution medium. One CD-ROM can hold up to one and half hours of digital audio or around 700 to 750 MB of computer data for that matter.

The production of CD-ROM starts as a glass plate, whose surface contain no deformities that

can be detected by the light beam. The glass plate is then coated with photo resists, a method which harden on exposure to light The image is produce by treating the glass plate as if it were a compact disc. The CD-ROM recording uses the principle of write once and read many times. It uses the optical recording method, using a beam of light from a miniature semiconductor laser. Once the photo resists has been processed, the pattern of pits will develop and this comprises the glass matter. The surface of the disc is then slivered so that the pits are protected and a thick layer of nickel is then plated over the surface.

To install a CD-ROM drive, there must be a free drive bay and the computer system must also have a sound card installed or a spare slot into which either a sound card or a CD-ROM drive can be placed. Before installation all the jumper settings should be properly done according to the specification. Once the CD-ROM drive is fitted in the drive bay with proper jumper settings, necessary software can be installed to make the CD-ROM drive work.

As far as CD-ROM is concerned, the main feature of it is the huge stomge space and very high immunity from damage, the control system that is built into the CD systems and it is easy to locate different pieces of data, so that comparatively simple software can be used to guide the laser beam to find what is required.

3.5.6 Laser Disc

As CD-ROM, a laser disc uses the same recording media can record and play back high quality digital audio files. As compared to the CD-ROM, a laser disc can play back four channels at a time (two digital and two analog channels) whereas CD-ROM can play only two channels at a time. But the biggest difference between them is that laser disc stores video in analog signals. The disadvantages of using a laser disc is you can not work with video as through it were a digital video file, because the analog output of a laser disc is just like any other video source.

CD-ROM stores digital data on only one side of the disc, whereas the laser disc stores an analog video signal on both sides of the disc.

3.6 SUMMARY

This unit introduce you to a new concept in information technology; Multimedia. With a number of examples it explains how slowly but steadily it has started to creep into our life in one or the other way. You were also explained various components of multimedia like graphics, sound, animation, digital audio and video and it talked about their characteristics and various storage formats they use. In a great length it introduces you to various storage media used for multimedia elements and their functions.

3.7 FURTHER READINGS

Graphics and Drawing

Corel Draw S/S by John Campbell & Marion Pye (Butterworth- Heinemann)

Computer-aided Design on a Shoestring by Ian Sinclair (BSP)

Illustrated AutoSketch 3 by Ian Sinclair (David Fulton Publishers)

Sound and MIDI

Practical MIDI Handbook by R.A. Penfold (PC Publishing)

Advanced MIDI Users Guide by R.A. Penfold (PC Publishing)

Introducing Digital Audio by Ian Sinclair (PC Publishing)

PC Music Handbook by Heywood and Evan (PC Publishing)

MIDI Survival Guide by Vic Lennard (PC Publishing)