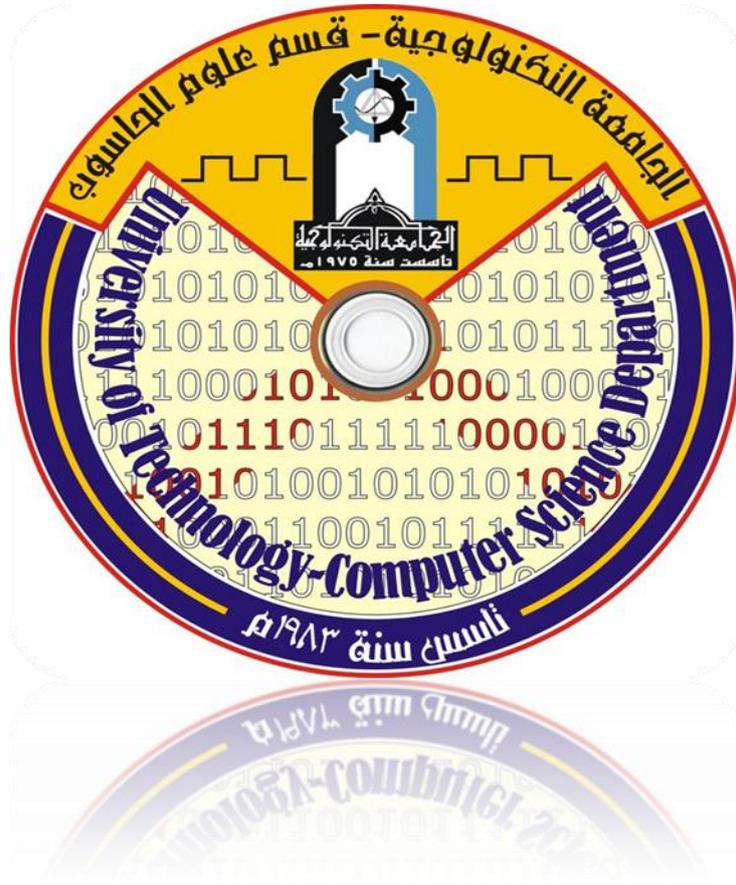


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1st Class

Fundamentals of Digital Media

أساسيات الوسائط الرقمية

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Introduction to Multimedia

Multimedia means that computer information can be represented through **text, images, graphics, audio, video and animation** in addition to traditional media.

Video can be considered as an **integrated Multimedia** because it contains all the components of multimedia (images, sound and text).

Frame is any number of images in a time period (30 images per second), those images are similar (identical) in characteristics.

A good general working **definition** for this module is:

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 media sources e.g. text, graphics, images, sound/audio, animation and/or video.
- **A Multimedia System** is a system capable of processing multimedia data and applications and supports more than a single kind of media
- **A Multimedia System** is characterized by the processing, storage, generation, manipulation and rendition of Multimedia information.
- The development of powerful multimedia computers and the evolution of the Internet have led to an explosion of applications of multimedia worldwide. These days' multimedia systems are used for **education, in presentations, as information kiosks** (أكشاك المعلومات) [In information technology, a kiosk (pronounced KEE-ahsk) is a small physical structure (often including a computer and a display screen) that displays information for people walking by , and in the **gaming industry**. In fact, multimedia has

applications everywhere: in businesses, at schools and universities, at home, and even in public places.

- The word **multimedia** is a combination derived from **multiple and media**. The word medium (the singular of media) means a transmission channel. For example, sound is transmitted through the medium of air, or electricity is transmitted through the medium of wires. Similarly, poetry could be considered a medium for transmitting our thoughts.

Elements of Multimedia

We have seen that a multimedia system consists of several elements such as sound, graphics, text, and video. We now describe what each one contains.

- 1) The first element of multimedia we consider is **audio**. The word audio is slightly different from **sound**. Audio consists of the sounds we can hear. This may seem contradictory, but it is well known that humans do not hear all possible sounds. For example, the sound emitted by the dog-whistle is recognized by dogs but not by humans.

Audio is one of the most appealing elements of any successful multimedia presentation. The impact of sound sets the mood and establishes the ambience (جو, بيئه , محيط) of a presentation. It can be used in a number of ways in a multimedia application, for example, to reinforce a message or theme, or to catch the interest and alert the audience. As part of audio content in a multimedia system, we may use music, sound effects, or speech to accomplish the goals of our presentation. The audio that appears in a multimedia presentation is of two types. It is either computer generated, or recorded and converted into a digital format.

- 2) **Graphic element.** Multimedia presentations are predominantly (في الغالب) graphics based. Information communicated through pictures is easier to understand and retain. Graphic elements in a multimedia system could be still pictures (like photographs) converted to digital format with the help of scanners, or generated on the computer. They may be flat (or two-dimensional), such as photographs and paintings, or they may appear solid (or three-dimensional), like sculptures (منحوتات) and objects around us. They may be either static graphic elements or animated. Further, animations may be two-dimensional, as in old cartoon films, or three-dimensional.
- 3) **Computer-generated text** is another element of multimedia. A few words appearing in a predominantly graphic multimedia system can have a powerful effect. On the Internet, text is used much more than on stand-alone multimedia products, so it takes on an added importance. Also, text and art can be mixed together in interesting ways to reinforce the message being transmitted. Text can also be animated in interesting ways.
- 4) Finally, we mention that **video** is another element of multimedia. Obviously, video and audio are closely related, and together they are the most effective means of communication that can be a part of the multimedia system.

Figure 1 shows the main screen of a multimedia product, with some of its graphics and text elements.



Figure 1: The main screen of a multimedia product

Multimedia involves multiple modalities (طرائق) of text, audio, images, drawings, animation, and video. **Examples of how these modalities are put to use:**

1. Video teleconferencing (عقد المؤتمرات عن بعد).
2. Distributed lectures for higher education (distance learning).
3. Tele-medicine (التطبيب عن بعد)
4. Co-operative work environments (بيئات العمل التعاوني).
5. “Augmented” reality (الحقيقة المدمجة) placing real-appearing computer graphics and video objects into scenes.
6. Including audio cues (العظة) for where video-conference participants are located.
7. Building searchable features into new video, and enabling very high- to very low-bit-rate use of new, scalable multimedia products.
8. Making multimedia components *editable* (للتحرير) .

1) Video conferencing

Also cold teleconferencing, in which people in different geographical locations can have a meeting- can see and hear one another- using computers and communications. videoconferencing systems rang from videophones (is a telephone with TV-like screen and built-in camera that allows you to see

the person you're calling) to group conference rooms with cameras and multimedia equipment to desktop system with small video cameras, microphones, and speakers.

Videoconferencing may eliminate the need for some travel for the purpose of meeting and allow people who cannot travel to visit "in person". Many organizations use video conferencing to take the place of face-to-face meetings.

2) Distance learning

Telecommunication technology is enabling many people to learn outside the class room, a process called distance learning. Distance learning can be point-to-point, where students gathered at a specific location and the class is transmitted to them in real time (different place, same time). The students are able to see and hear the professor, and the professor can hear the students off-site and may be able to see them as well. The off-site locations may be around the same campus (حرم الجامعة) or across the world.

Distance learning may also be asynchronous (different place, different time). Many courses are offered over the internet in prepackaged form.

3) Telemedicine

The use of medical information exchanged from one site to another via electronic communications for the health and education of the patient or healthcare provider and for the purpose of improving patient care. Telemedicine includes consultative (استشاري), diagnostic, and treatment services.

Interactivity

In a multimedia system, if the user has the ability to control what elements are delivered and when, the system is called an interactive system. Interactivity allows

the viewer to navigate through a presentation in their own way and at their own pace. Users can jump from topic to topic and skipping areas of little interest

- Traditional mass media include television, film, radio, and newspapers. These are called mass media, since the communication processes are one way, originating from a source and being delivered to a mass audience. These technologies also combine audio, video, graphics, and text, but in a way that is inflexible. For example, a film has a predefined beginning, middle, and end, irrespective of the audience watching it.
- With the power of the computer, the same media could be manipulated by the audience. In this manner, the audience does not need to remain passive, but becomes the user of the system. Thus, the key difference between mass media and multimedia is the shift from audience to users, and one-way communication to two-way communication. This is accomplished through interactivity.

To communicate with the system, the user can use a variety of devices such as the keyboard, mouse, tracking ball, touch screen, and pen-based mouse. Thus while designing a multimedia application; we have to decide the level of interactivity we wish to provide to the user of the system.

Multimedia Research Topics and Projects

To the computer science researcher, multimedia consists of a wide variety of topics:

- 1. Multimedia processing and coding:** multimedia content analysis, content-based multimedia retrieval, multimedia security, audio/image/video processing, compression, etc.
- 2. Multimedia system support and networking:** network protocols, Internet, operating systems, servers and clients, quality of service (QoS), and databases.
- 3. Multimedia tools, end-systems and applications:** hypermedia systems, user interfaces, authoring systems.

4. **Multi-modal interaction and integration:** “ubiquity” وجود الشيء في كل مكان — web-everywhere devices, multimedia education including Computer Supported Collaborative Learning, and design and applications of virtual environments.

Current Multimedia Projects

Many exciting research projects are currently underway. Here are a few of them:

1. **Camera-based object tracking technology:** tracking of the control objects provides user control of the process.
2. **3D motion capture:** used for multiple actor capture so that multiple *real* actors in a *virtual* studio can be used to automatically produce realistic *animated* models with natural movement.
3. **Multiple views:** allowing photo-realistic (video-quality) synthesis of virtual actors from several cameras or from a single camera under differing lighting.
4. **3D capture technology:** allow synthesis of highly realistic facial *وجهي* animation from speech.
5. **Specific multimedia applications:** aimed at handicapped *معاق* persons with low vision capability and the elderly *عجوز*
6. **Digital fashion:** aims to develop smart clothing that can communicate with other such enhanced clothing using wireless communication, so as to artificially enhance human interaction in a social setting.
7. **Electronic Housecall system:** an initiative for providing interactive health monitoring services to patients in their homes
8. **Augmented Interaction applications:** used to develop interfaces between real and virtual humans for tasks such as augmented storytelling.

Notes :

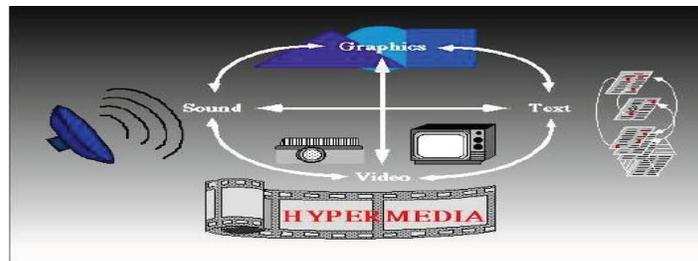
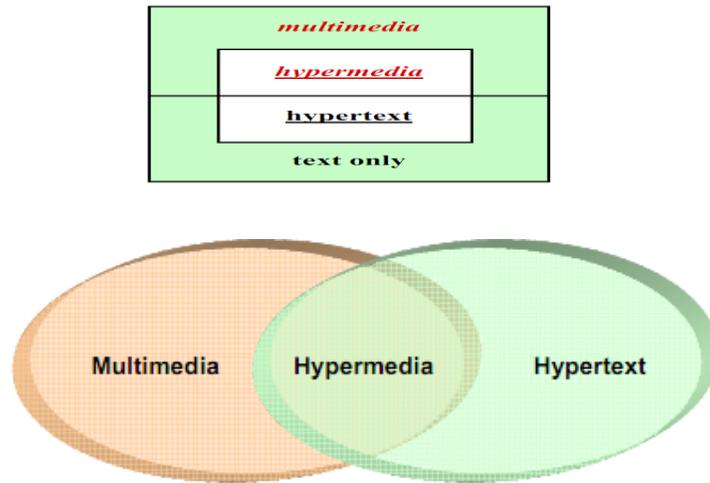
- Multimedia is *linear*, when it is not interactive and the users just sit and watch as if it is a movie.
- Multimedia is *nonlinear*, when the users are given the navigational control and can browse the contents at will.

2.1 Multimedia and Hypermedia

History of Multimedia:

1. **Newspaper:** perhaps the *first* mass communication medium uses text, graphics, and images.
 2. **Motion pictures:** conceived of in 1830's in order to observe motion too rapid for perception by the human eye.
 3. **Wireless radio transmission:** Guglielmo Marconi, at Pon-tecchio, Italy, in 1895.
 4. **Television:** the new medium for the 20th century, established video as a commonly available medium and has since changed the world of mass communications.
- **Hypertext** system: meant to be read nonlinearly, by following links that point to other parts of the document, or to other documents (Fig. 2.1)
 - **Hypermedia:** not constrained to be text-based, can include other media, e.g., graphics, images, and especially the continuous media | sound and video figure (2.2). Example Hypermedia Applications:
 1. The World Wide Web (WWW) is the best example of a hypermedia application.
 2. Power point
 3. Adobe Acrobat
 - **Multimedia** means that computer information can be represented through audio, graphics, images, video, and animation in addition to traditional media.

Hypertext and hypermedia: scheme



Figure(2.1): Hypermedia

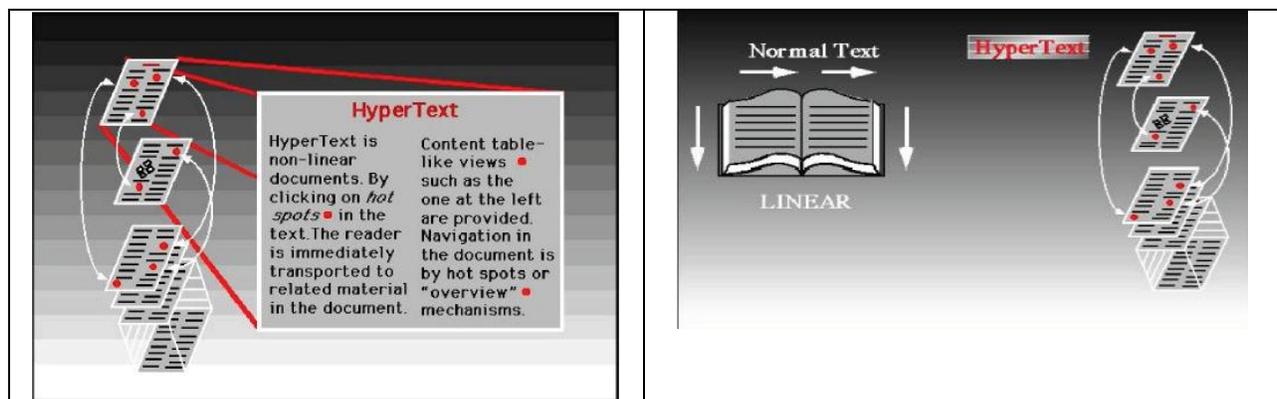


Figure (2.2): Hypertext is nonlinear

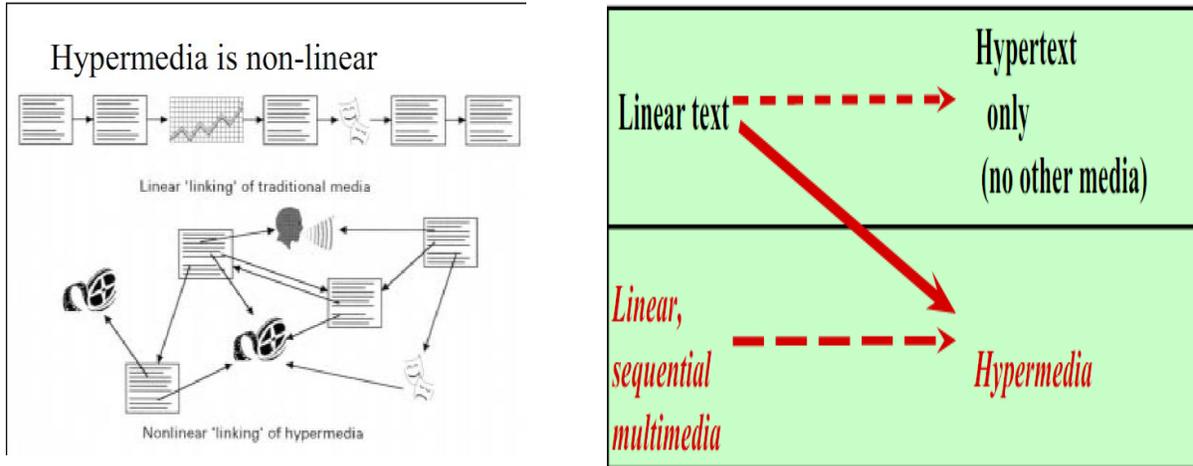


Figure (2.3): Hypermedia (linear and non-linear) .

On a website:

- Hyperlinking allows the user to “jump” from one part of the multimedia application to another .
- The [World Wide Web](#) is a partial hypermedia system since it supports graphical [hyperlinks](#) and links to sound and video files. New hypermedia systems under development will allow objects in computer [videos](#) to be hyperlinked

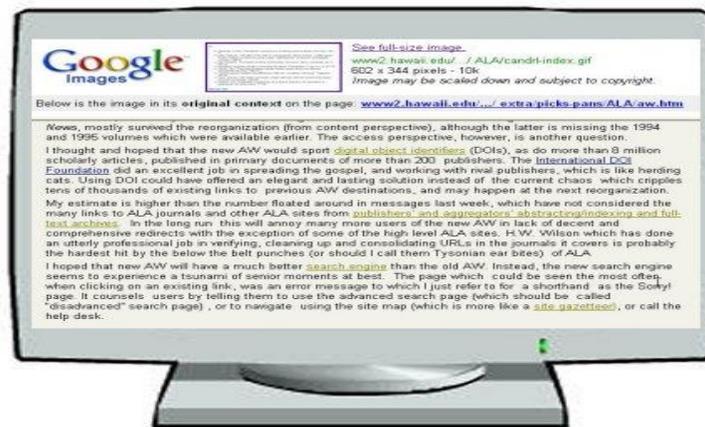


Figure (2.4): Hyperlinking

Internet Technology

The Internet began as a small group of interconnected LANs and has grown into a worldwide network that spans many thousands of networks and millions of computers. The Internet really is nothing more than a huge wide area network. It is one of the fastest growing sources of information and a large computer network of networks all connected together and sharing resources and information. No one actually know how many web pages are actually out there – last count was about 4 billion – but this number changes daily even hourly.

Internet enables us to find information that would otherwise be time-consuming, difficult, or impossible to locate. It has enabled us to shop and buy without leaving home. Traditionally, the Internet had several main applications

1. E-mail.
2. Newsgroup.
3. E-commerce.

Definition: Internet

A Worldwide network of computer and data communications equipment connected by routers that are configured to pass traffic among any computers attached to network.

- The Internet is a global system of interconnected computer networks that use the standard Internet protocol suite (TCP/IP) to serve billions of users worldwide.
- It is a network of networks that consists of millions of private, public, academic, business, and government networks, of local to global scope, that are linked by cables, wireless and optical networking technologies.

- The Internet carries large amount of information resources and services, such as the inter-linked hypertext documents of the World Wide Web (WWW) and the infrastructure to support email.
- Came in the mid-1970s under the auspices of DARPA, the United States Defense Advanced Research Projects Agency.
- These projects led to the birth of a data communication protocol called IP, the Internet Protocol, which allowed several computers to communicate through a network, the Internet, formed by the interconnection of several networks.
- Due to the wide availability of implementations of the suite of TCP/IP protocols, the Internet began what would subsequently become one of its basic features, an exponential growth that only began to decline slightly in mid-2002.

➤ **To connect you need**

- An access device (*computer*)
- A means of connection (*phone line, cable, or wireless*)
- An *Internet Service Provider (ISP)*: a commercial organization with permanent connection to the Internet that sells temporary connections to subscribers.

➤ **Client and Server model**

- Servers:
 - Computers that provide networking services (e.g., sharing files, sharing Web pages) to other computers
- Clients:
 - Computers that access/request and receive networking services from servers

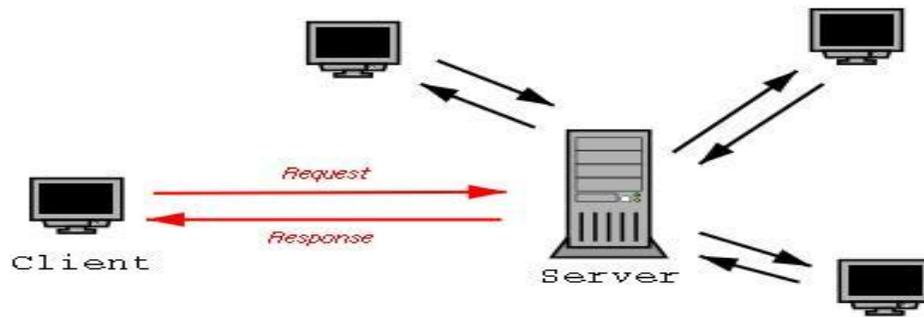


Figure (2.5): Client and Server model.

2.1 The World Wide Web

The World Wide Web (WWW) is a repository of information linked together all over the world. The WWW has a unique combination of flexibility, portability, and user-friendly features that distinguish it from other services provided by the Internet. The World Wide Web incorporates all the internet services listed above, and more, including the ability to view images, look at video, and hear sound recordings.

- The **World Wide Web**, or **Web**, consists of a worldwide collection of electronic documents (**Web pages**)
- A **Web site** is a collection of related Web pages and associated items
- A **Web server** is a computer that delivers requested Web pages to your computer
- **Web 2.0** refers to Web sites that provide a means for users to interact
- A **Web browser**, or **browser**, allows users to access Web pages and Web 2.0 programs (Internet Explorer, Firefox , Opera, Safari, Google Chrome)
- ❖ **Web servers** are computers (software and hardware) that are capable of providing information (e.g., documents, files, audio, video) to Web clients

- A Web server processes the requests and returns the requested documents, pictures, videos, audio, and files to the client
 - To be a Web server, a software called HTTP Daemon (HTTPD) or Web server software must be installed in a computer
 - Examples of HTTPD are **Apache** and **Internet Information Services (IIS)**
- ❖ **Web clients** are computers (software and hardware) that are capable of requesting information (e.g., documents, files, audio, video) from Web servers
- A Web client requests the documents, pictures, videos, audio, and files that are located in the server
 - To be a Web client, a software called Web browser must be installed in a computer
 - Examples of Web browser are **Internet Explorer** and **Mozilla Firefox**.

2.2 Internet vs. the Web

- Internet is like the network of roads in a city, whereas Web is a service like the Bus Service that run over those roads. Just like other services can use the roads (e.g. wagons), so can other services on the Internet (e.g. ftp).
- The Internet is a global system of **interconnected computer networks**.
- In contrast, the **Web is one of the services** that run on the Internet.
- The Web is a collection of interconnected documents and other resources, linked by hyperlinks and URLs. The Web is an application running on the Internet.

- ❖ **TCP/IP** Stands for "Transmission Control Protocol/Internet Protocol." These two protocols were developed in the early days of the Internet by the U.S. military. The purpose was to allow computers to communicate over long distance networks. The TCP part has to do with the verifying delivery of the packets. The IP part refers to the moving of data packets between nodes. TCP/IP has since then become the foundation of the Internet. Therefore, TCP/IP software is built into all major operating systems, such as Unix, Windows, and the Mac OS.

- ❖ **Web 2.0** is term that was introduced in 2004 and refers to the second generation of the World Wide Web. The term "2.0" comes from the software industry, where new versions of software programs are labeled with an incremental version number. Like software, the new generation of the Web includes new features and functionality that was not available in the past. However, Web 2.0 does not refer to a specific version of the Web, but rather a series of technological improvements. Some examples of features considered to be part of Web 2.0 are listed below:
 - Blogs - also known as Web logs, these allow users to post thoughts and updates about their life on the Web.
 - Wikis - sites like Wikipedia and others enable users from around the world to add and update online content.
 - Social networking - sites like Face book and MySpace allow users to build and customize their own profile sand communicate with friends.

- ❖ **HTTP:** Short for **H**yper**T**ext **T**ransfer **P**rotocol, the underlying protocol used by the World Wide Web. HTTP defines how messages are formatted and transmitted, and what actions Web servers and browsers should take in

response to various commands. For example, when you enter a URL in your browser, this actually sends an HTTP command to the Web server directing it to fetch and transmit the requested Web page

❖ **HTTPS** stands for Hyper Text Transfer Protocol over SSL (Secure Socket Layer). It is a TCP/IP protocol used by Web servers to transfer and display Web content securely. The data transferred is encrypted so that it cannot be read by anyone except the recipient. HTTPS is used by any Web site that is collecting sensitive customer data such as banking information or purchasing information. If you are making a transaction online, you should make sure that it is done over HTTPS so that the data remains secure. You can tell when a page is using HTTPS in two ways:

1. There will be a lock icon in the browser window pane (usually at the bottom).

2. The URL will say "https://"

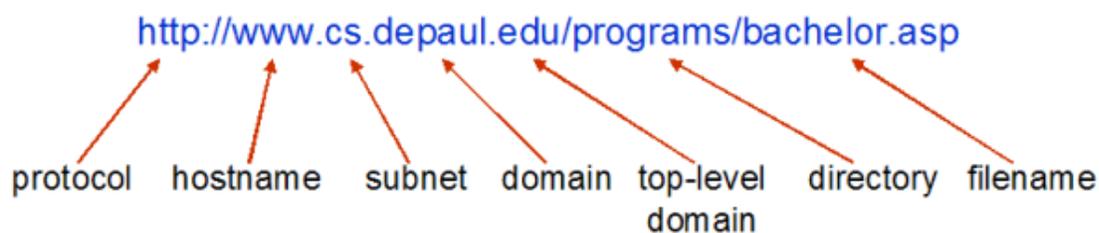
❖ **.HTTPD:**(pronounced as separate letters) Short for HTTP daemon, a software program that runs in the background of a Web server and waits for incoming server requests. The daemon answers the requests automatically and serves the hypertext and multimedia documents over the Internet using HTTP

❖ The other main standard that controls how the World Wide Web works is **HTML**, Short for **HyperText Markup Language**, the authoring language used to create documents on the World Wide Web. HTML defines the structure and layout of a Web document by using a variety of tags and attributes. The correct structure for an HTML document starts with `<HTML><HEAD>(enter here what document is about)<BODY>` and ends

with `</BODY></HTML>`. All the information you'd like to include in your Web page fits in between the `<BODY>` and `</BODY>` tags.

❖ URL Uniform Resource Locator

- Address in a format that identifies an individual object (web page, image, sound file, etc.) on the Internet
- Analogy is a phone number
- URL is unique for each object
- Must be typed exactly (often case sensitive)
- Format: protocol://server name/path/file name
- **protocol** = rules for transferring the data (for example, http for a web page)
- **server** = fully qualified domain name (or IP address) of the host computer where object is located
- **path** = folder or directory in the host computer where object will be found
- **file** = file name of the object (web page, image, sound , etc.)



Overview of Multimedia Software Tools

The categories of software tools briefly examined here are:

1) Music Sequencing and Notation

- a) **Cakewalk**: now called Pro Audio. The term **sequencer** comes from older devices that stored sequences of notes events", in MIDI (Musical Instrument Digital Interface). It is also possible to insert WAVE files and Windows MCI commands (for animation and video) into music tracks (MCI is a ubiquitous component of the Windows API.)
- b) **Cubase**: another sequencing/editing program, with capabilities similar to those of Cakewalk. It includes some digital audio editing tools.
- c) **Macromedia Sound edit**: mature program for creating audio for multimedia projects and the web that integrates well with other Macromedia products such as Flash and Director.

2) Digital Audio

- a) **Digital Audio** tools deal with accessing and editing the actual sampled sounds that make up audio:
- b) **Cool Edit**: a very powerful and popular digital audio toolkit; emulates a professional audio studio multitrack productions and sound file editing including digital signal processing effects.
- c) **Sound Forge**: a sophisticated PC-based program for editing audio WAV files.
- d) **Pro Tools**: a high-end integrated audio production and editing environment MIDI creation and manipulation; powerful audio mixing, recording, and editing software.

3) Graphics and Image Editing

- a) **Adobe Illustrator:** a powerful publishing tool from Adobe. Uses vector graphics; graphics can be exported to Web.
- b) **Adobe Photoshop:** the standard in a graphics, image processing and manipulation tool. Allow layers of images, graphics, and text that can be separately manipulated for maximum flexibility.
- c) **Filter factory** permits creation of sophisticated lighting filters.
- d) **Macromedia Fireworks:** software for making graphics specifically for the web.
- e) **Macromedia Freehand:** a text and web graphics editing tool that supports many bitmap formats such as GIF, PNG, and JPEG

4) Video Editing

- a) **Adobe Premiere:** an intuitive, simple video editing tool for **nonlinear** editing, putting video clips into any order: Video and audio are arranged in tracks". Provide a large numbers of video and audio tracks, super- impositions and virtual clips.
- b) **Adobe After Effects:** a powerful video editing tool that enables users to add and change existing movies. Can add many effects: lighting, shadows, motion blurring; layers.
- c) **Final Cut Pro:** a video editing tool by Apple; Macintosh only.

5) Animation

- a) **Multimedia APIs: Java3D:** API used by Java to construct and render 3D graphics, similar to the way in which the Java Media Framework is used for handling media files.

1. Provides a basic set of object primitives (cube, splines, etc.) for building scenes.
2. It is an abstraction layer built on top of OpenGL or DirectX (the user can select which).

b) **DirectX** : Windows API that supports video, images, audio and 3-D animation

c) **OpenGL**: the highly portable, most popular 3-D API

6) Multimedia Authoring

Multimedia Authoring is the process of creating a multimedia production. It involves assembling or sequencing different media elements, adding interactivity, and then packaging the production for distribution to the end users. The end users are the target audience who will be viewing your final production. For educational multimedia it is also important to create an effective instructional environment.

Multimedia authoring programs allow you to combine all the communications media into an interactive presentation. Most of these authoring programs or tools have their own scripting language that lets you add interactivity to your production. Adobe Flash and Adobe Director are two of the most common multimedia authoring programs that are widely used in the market. Adobe Flash has its scripting language called “Action Script” while Director's scripting language is called “Lingo”.

The authoring process can be used to develop many different types of products, including:

- Educational applications
- Computer-based training
- Reference systems
- Simulations
- Entertainment programs and games
- Training systems

Multimedia authoring is creation interactive applications and there are three common classifications of interactivity:

- a) **A linear presentation** is one in which the author decides the sequence and manner in which information is presented. The user controls only the pace.
 - b) **A branching program** is one in which the user has some control over the sequence of presentation by selecting from a group of choices such as from a main menu. The author still maintains the control of deciding what to include in the choices available at any point in the program.
 - c) **Hypermedia** - Hypermedia can be thought of as a web of interrelated information in which the user is in almost complete control of the pace and, to a somewhat lesser extent, the sequence and content of the presentation. Links provide for random access of information.
-
- ❖ **API**, an abbreviation of *application program interface*, is a set of routines, protocols, and tools for building software applications. A good API makes it easier to develop a program by providing all the building blocks. A programmer then puts the blocks together. Most operating environments, such as MS-Windows, provide an API so that programmers can write applications consistent with the operating environment.
 - ❖ An application programming interface (API) is an interface implemented by a software program to enable interaction with other software graphical user interface: a user interface based on graphics (icons and pictures and menus) instead of text.
 - ❖ **CBT**, Acronym for *computer-based training*, a type of education in which the student learns by executing special training programs on a computer. CBT is especially effective for training people to use computer applications

because the CBT program can be integrated with the applications so that students can practice using the application as they learn.

- ❖ Graphical User Interface (**GUIs**) most systems interacted with the user with character based user interfaces (CUIs). Because of the inherent design of the CUI systems the interaction with the user was very predictable. With CUI the system would present a menu (or some similar fixed command interface) to the user or implement some specific command grammar. From there the system would then wait for the user to make a choice.

Multimedia Authoring Tools

- 1) Multimedia authoring tools provide the important framework you need for organizing and editing the elements of multimedia like graphics, sounds, animations and video clips.
- 2) Authoring tools are used for designing interactivity and the user interface, for presentation your project on screen and assembling multimedia elements into a single cohesive project.
- 3) Authoring software provides an integrated environment for binding together the content and functions of your project.
- 4) Authoring systems typically include the ability to create, edit and import specific types of data; assemble raw data into a playback sequence or cue sheet and provide structured method or language for responding to user input.

Types of Authoring Tools

The various authoring tools can be classified in three categories based on the metaphor used for sequencing or organizing multimedia elements and events.

(1) Card or page based tools

In these authoring systems, elements are organized as pages of a book or a stack of cards. These tools are best used when the bulk of your content consists of elements that can be viewed individually, like the pages of a book or cards in a card file. The authoring system lets you link these pages or cards into organized sequences. You can jump, on command, to any page you wish in the structured navigation pattern.

(2) Icon based, event driven tools

In these authoring systems, multimedia elements and interactions cues are organized as objects in a structural framework or process. Icon base, event-driven tools simplify the organization of your project and typically display flow diagrams of activities along branching paths. In complicate structures, this charting is particularly useful during development.

(3) Time based tools

In these authoring systems, elements and events are organized along a timeline, with resolutions as high or higher than 1/30 second. Time based tools are best to use when you have a message with a beginning and an end. Sequentially organized graphic frames are played back at a speed that you can set.

Features of Authoring Tools

Features of multimedia authoring tools are as mention below:

(1) Editing features

The elements of multimedia – image, animation, text, digital audio and MIDI music and video clips – need to be created, edited and converted to standard file formats and the specialized applications provide these capabilities. Editing tools for these elements, particularly text and still images are often included in your authoring system.

(2) Organizing features

The organization, design and production process for multimedia involves storyboarding and flowcharting. Some authoring tools provide a visual flowcharting system or overview facility for illustrating your project's structure at a macro level. Storyboards or navigation diagrams too can help organize a project.

(3) Programming features

Authoring tools that offer a very high level language or interpreted scripting environment for navigation control and for enabling user inputs such as Macromedia Director, Macromedia Flash,

HyperCard, MetaCard and ToolBook are more powerful. The more commands and functions provided in the scripting language, the more powerful the authoring system.

(4) Interactivity features

Interactivity empowers the end users of your project by letting them control the content and flow of information. Authoring tools should provide one or more levels of interactivity:

Simple branching, which offers the ability to go to another section of the multimedia production. Conditional branching, which supports a go-to based on the result of IF-THEN decision or events. A structured language that supports complex programming logic, such as nested IF-THENS, subroutines, event tracking and message passing among objects and elements.

(5) Performance tuning features

Complex multimedia projects require extra synchronization of events. Accomplishing synchronization is difficult because performance varies widely among the different computers used for multimedia development and delivery. Some authoring tools allow you to lock a production's playback speed to specified

computer platform, but other provides no ability what so ever to control performance on various systems.

(6) Playback features

When you are developing multimedia project, you will continually assembling elements and testing to see how the assembly looks and performs. Your authoring system should let you build a segment or part of your project and then quickly test it as if the user were actually using it.

(7) Delivery features

Delivering your project may require building a run-time version of the project using the multimedia authoring software. A run-time version allows your project to play back without requiring the full authoring software and all its tools and editors. Many times the run time version does not allow user to access or change the content, structure and programming of the project. If you are going to distribute your project widely, you should distribute it in the run-time version.

(8) Cross-Platform features

It is also increasingly important to use tools that make transfer across platforms easy. For many developers, the Macintosh remains the multimedia authoring platform of choice, but 80% of that developer's target market may be Windows platforms.

(9) Internet Playability

Due to the Web has become a significant delivery medium for multimedia, authoring systems typically provide a means to convert their output so that it can be delivered within the context of HTML (HyperText Markup Language) , either with special plug-in or embedding Java, JavaScript or other code structures in the HTML document.

Making Multimedia

You will be introduced to the workshop where multimedia is made, with guidance and suggestions for getting started, and you will learn about planning a project.

The Stages of a Multimedia Project

Most multimedia and web projects must be undertaken in stages. Some stages should be completed before other stages begin, and some stages may be skipped or combined. Here are the four basic stages in a multimedia project:

1. Planning and costing A project always begins with an idea or a need that you then refine by outlining its messages and objectives.

Planning means identify how you will make each message and objective work within your authoring system.

- Before you are begin developing, plan out the writing skills, graphic art, music, video, and other multimedia expertise that you will require.
- Develop a creative “**look and feel**” (what a user sees on a screen and how he or she interacts with it), as well as a structure and a navigational system that will allow the viewer to visit the messages and content.
- Estimate the time you’ll need to do all the elements, and then prepare a budget.
- Work up a short **prototype** or **proof-of-concept**, a simple, working example to demonstrate whether or not your idea is feasible. The ease with which you can create materials with today’s production and authoring tools tempts new developers to immediately move into production jumping in before planning.

This often results in false starts and wasted time and, in the long run, higher development cost. The more time you spend getting a handle on your project by defining its content and structure in the beginning, the faster you can later build it, and the less reworking and rearranging will be required midstream. Think it through before you start! Your creative ideas and trials will grow into screens and buttons (or the look and feel), and your proof-of-concept will help you test whether your ideas will work. You may discover that by breaking the rules, you can invent something terrific!

2. Designing and producing Perform each of the planned tasks to create a finished product. During this stage, there may be many feedback cycles with a client until the client is happy.

3. Testing Test your programs to make sure that they meet the objectives of your project, work properly on the intended delivery platforms, and meet the needs of your client or end user.

4. Delivering Package and deliver the project to the end user. Be prepared to follow up over time with tweaks, repairs, and upgrades.

What You Need: The Intangibles

1) You need hardware, software, and good ideas to make multimedia. To make *good* multimedia, you need talent and skill.

2) You also need to stay organized, because as the construction work gets under way, all the little bits and pieces of multimedia content the old audio recordings of the Christmas-two-years-ago snapshot of your niece, the 41 articles still to scan with your optical character recognition (OCR) program will get lost under growing CDs, video tapes, phone messages, permissions and releases, Xerox copies, and mail.

3) You will need time and money (for consumable resources such as CD-R blanks and other memory or digital storage, for telephoning and postage, and possibly for paying for special services and time, yours included), and you will need to budget these precious commodities.

4) You may also need the help of other people.

Multimedia development of any scale greater than the most basic level is inherently a team effort: artwork is performed by graphic artists, video shoots by video producers, sound editing by audio producers, and programming by programmers.

Creativity

Before beginning a multimedia project, you must first develop a sense of its scope and content. Let the project take shape in your head as you think through the various methods available to get your message across to your viewers.

Multimedia Skills

Computer scientists, physicians, and firemen share highest honors as the most respected professions in the United States, Are multimedia developers computer scientists? Or are they programmers, graphic artists, musicians, animators, storyboard crafts people, information specialists, instructional designers, and/or Renaissance authors? However you define them, they come from all corners of the computer, art, literary, film, and audio worlds.

- **Video producers** become experts with computer-generated animations and MIDI controls for their edit suites. Architects become bored with two-dimensional drafting and create three-dimensional animated walkthroughs.
- **Oil field** engineers get tired of manipulating complex data sets and design mouse driven human interfaces.

- **Classical painters** learn the electronic elements of red, green, and blue and create fantastic, computer based artwork.

A multimedia developer might be any or all of these and typically doesn't fit a traditional management information system (MIS) or computer science mold; many have never seen a line of C++ code or booted up a Linux server. Perhaps, in the broadest definition, multimedia developers might simply be called information technology workers.

Consider Leonardo Vinci, the Renaissance man who was scientist, architect, builder, creative designer, craftsman, and poet folded into one. To produce good multimedia, you will need a similar diverse range of skills detailed knowledge of computers, text, graphic arts, sound, and video.

These skills, the **multimedia skill set**, may be available in a single individual or, more likely, in a composite of individuals working as a team.

Complex multimedia projects are, indeed, often assembled by teams of artists and computer crafts people, where tasks can be delegated to those most skilled in a particular discipline or craft.

Many job titles and collaborative team roles for multimedia development are being adapted to pull from a mix of motion picture industry, radio and television broadcasting, and computer software industry experiences.

WARNING *A multimedia expert working alone will be hard-pressed to Compete with a multi disciplinary team of experts and may be overwhelmed by the sheer amount of effort required to build a complex project single-handedly.*

The Team

A typical team for developing multimedia for DVD or the Web consists of people who bring various abilities to the table. Often, individual members of multimedia production teams wear several hats: graphic designers may also do interface design, scanning, and image processing.

A project manager or producer may also be the video producer or scriptwriter.

Depending upon the scope and content of your project and the mix of people required, according to a professor Wes Baker, a multimedia production team may require as many as 18 discrete roles, including:

- 1) Executive Producer
- 2) Producer/Project Manager
- 3) Creative Director/Multimedia Designer
- 4) Art Director/Visual Designer
- 5) Artist
- 6) Interface Designer
- 7) Game Designer
- 8) Subject Matter Expert
- 9) Instructional Designer/Training Specialist
- 10) Scriptwriter
- 11) Animator (2-D/3-D)
- 12) Sound Producer
- 13) Music Composer
- 14) Video Producer
- 15) Multimedia Programmer
- 16) HTML Coder
- 17) Lawyer/Media Acquisition
- 18) Marketing Director

Graphics in Multimedia Applications

- Graphics is the art of drawing, especially as used in mathematics, engineering.....etc.
- Graphics are usually editable image.
- Input: Graphics are usually generated by a graphics editor program.
- Graphics input devices: keyboard (for text and cursor control), mouse and graphics tablet.
- Format: constructed by the composition of primitive objects such as lines, polygons, circles, curves and arcs.
- Do not take up a very high storage

Computer Graphics refers to any computer device or program that makes a computer capable of displaying and manipulating pictures. For example,

- 1) ***Laser printers and plotters are graphics devices*** because they permit the computer to output pictures.
- 2) ***A graphics monitor*** is a display monitor that can display pictures.
- 3) ***A graphics board (or graphics card)*** is a printed circuit board that, when installed in a computer, permits the computer to display pictures.

The following are also considered *graphics applications*:

- 1) **Paint programs** : Allow you to create rough freehand drawings. The images are stored as bit maps and can easily be edited.
- 2) **Illustration/design programs**: Supports more advanced features than paint programs, particularly for drawing curved lines. The images are usually stored in vector-based formats. Illustration/design programs are often called *draw programs*.

- 3) **Presentation graphics software:** Lets you create bar charts, pie charts, graphics, and other types of images for slide shows and reports. The charts can be based on data imported from spreadsheet applications.
- 4) **Animation software:** Enables you to chain and sequence a series of images to simulate movement. Each image is like a frame in a movie.
- 5) **CAD software:** Enables architects and engineers to draft designs.
- 6) **Desktop publishing :** Provides a full set of word-processing features as well as fine control over placement of text and graphics, so that you can create newsletters, advertisements, books, and other types of documents.

In general, applications that support graphics require a **powerful CPU** and a **large amount of memory**.

Most PC programs, for instance, require **VGA (Video Graphics Array)** graphics. If your computer does not have built-in support for a specific graphics system, you can insert a video adapter card.

The quality of most graphics devices is determined by their *resolution*-how many points per square inch they can represent-and their *color* capabilities.

Computer Graphics Modes

There are two extremely modes:

1. The passive (none interactive mode).
2. The interactive mode.

A typical system may be a hybrid of both modes.

1. The passive mode.

In this mode a system usually operate in a batch environment. The input is usually an already written program saved at a disk, the output devices are usually hard copy i.e. they provide a permanent pictures. Such as printers and plotters.

2. The interactive mode

In this mode the user and the computer interact or converse on-line. The input devices used with this mode are mouse, keyboard, joystick, while the output device must be a display monitor.

Interactive Graphics Display

The modern graphics display is extremely simple in construction. It consists of three components:

- 1- A digital memory, or frame buffer, in which the displayed image is stored as a matrix of intensity values.
- 2- A display monitor.
- 3- A display controller, which is a simple interface that passes the contents of the frame buffer to the monitor.

Cartesian Coordinate System (نظام الإحداثيات الديكارتية)

A coordinate system provides a framework for translating geometric ideas into numerical expressions.

In a two-dimensional plane, we pick any point and single it out as a reference point called the origin. Through the origin we construct two perpendicular number lines called axes. These are labeled the X axis and the Y axis. Any point in two dimensions in this X-Y plane can be specified by a pair of numbers, the first number is for the X axis, and the second number is for the Y axis.

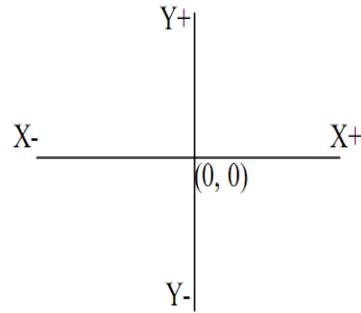


Figure 1: X and Y coordination

Raster scan refresh graphics display (device coordinate system)

A raster CRT graphics devices can be considered a matrix of discrete cells each of which can be made bright. Thus it is a point plotting devices.

It is not possible except in special cases to directly draw a straight line from one addressable point, or pixel in the matrix to another addressable point, or pixel. The line can only approximated by a series of dots (pixels) close to the path of the line.

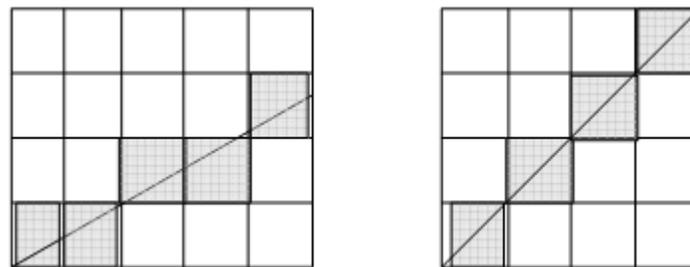


Figure 2: Discrete Cells

Only in the special cases of completely horizontal, vertical or 45 degree lines will a straight line result. All other lines will appear as a series of stair steps. *This is called aliasing (التعرج).*

The most common method of implementing a raster CRT graphics device utilizes a frame buffer. A frame buffer is a large, contiguous piece of computer

memory. As a minimum there is one memory bit for each location or pixel in the raster. This amount of memory is called a bit plane.

A 512 X 512 element square raster requires 2^{18} memory bits in a single Bit plane. The picture is built up in the frame buffer 1 bit at a time.

There are two types of graphics:

- 1) Draw-type graphics or vector graphics – represent an image as a geometric shape
- 2) Bitmap graphics – represents the image as an array of dots, called pixels

1) Draw Type Graphics

Draw type or vector graphics have some features such as:-

- Geometric shape stored as set of instructions
- Smaller than bitmap
- Resize, rotate, no distortion



Figure 3: Draw Type Graphics

2) Bitmap Graphics have some features:-

- Bitmaps – array of dots or pixels
- Color depth per pixel
- High quality pictures
- Larger than draw-type



Figure 4: Bitmap Graphics (BMP)



Figure 5: Graphics Programs for Normal image

Graphic Image Sources

Alternative image sources

- Clip art
- Stock photographs
- Video images
- Still images
- Scanned images
- Photo CD's
- Screen-capture program

Digital Images

An image must be converted to numerical form before processing. This conversion process is called digitization, and a common form is illustrated in Figure (1). The image is divided into small regions called *picture elements*, or *pixel* for short. The most common subdivision schema is the rectangular sampling grid shown in Figure (1). The image is divided into horizontal lines made up of adjacent pixels. Each pixel has a location or address (Line or row number and sample or column number) and an integer value called gray level. This array of digital data is now a candidate for computer processing.

From above we can define Digital Image as a sampled, quantized function of two dimensions $f(x,y)$, which has been generated by optical means, sampled in an equally spaced rectangular grid pattern, and quantized in equal intervals of gray levels.

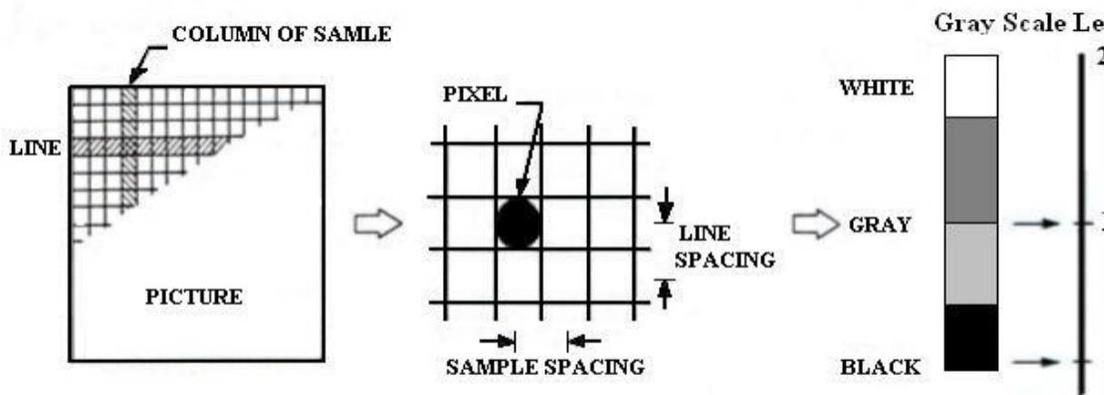


Figure (1) Digitizing an Image

Sampling

Sampling : is a process of measuring the value of the image function $f(x,y)$ at discrete *intervals in space*. Each sample corresponds to a small square area of the image, known as a pixel. A digital image is a two-dimensional array of these pixels. Pixels are indexed by x and y coordinates, with x and y

taking integer values.

In the figure below we see one line of a video signal being sampled (digitized) by instantaneously measuring the voltage of the signal at fixed intervals in time. The value of the voltage at each instant is converted into a number that is stored, corresponding to the brightness of the image at that point.

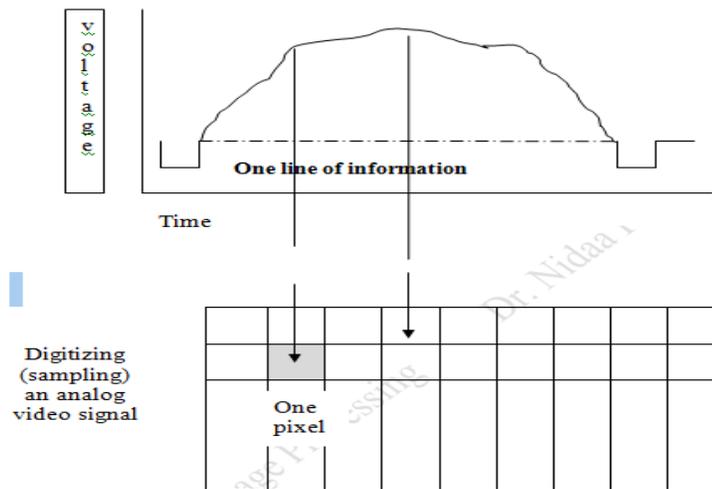


Figure (2) Digitizing (Sampling) an Analog Video Signal

Quantization

Quantization: is the representation of the brightness of each pixel by an integer value. Since digital computer process number, it is necessary to reduce the continuous measurement value to discrete units and represent them by integer number.

The digital image is 2D- array as:

$$\begin{pmatrix} I(0,0) & I(0,1) & \dots & I(0,N-1) \\ I(1,0) & I(1,1) & \dots & I(1,N-1) \\ \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots \\ I(N-1,0) & I(N-1,1) & \dots & I(N-1,N-1) \end{pmatrix}$$

Image Representation

The digital image $I(r, c)$ is represented as a two-dimensional array of data, where each pixel value corresponds to the brightness of the image at the point (r, c) . In linear algebra terms, a two-dimensional array like our image model $I(r, c)$ is referred to as a matrix, and one row (or column) is called a vector.

There are different types of images:

1. Binary Image

Binary images are the simplest type of images and can take on two values, typically black and white, or '0' and '1'. A binary image is referred to as a 1 bit/pixel image because it takes only 1 binary digit to represent each pixel. These types of images are most frequently in computer vision application where the only information required for the task is general shapes, or outlines information. For example, to position a robotics gripper to grasp (يمسك) an object or in optical character recognition (OCR). Binary images are often created from gray-scale images via a threshold value is turned white ('1'), and those below it are turned black ('0').

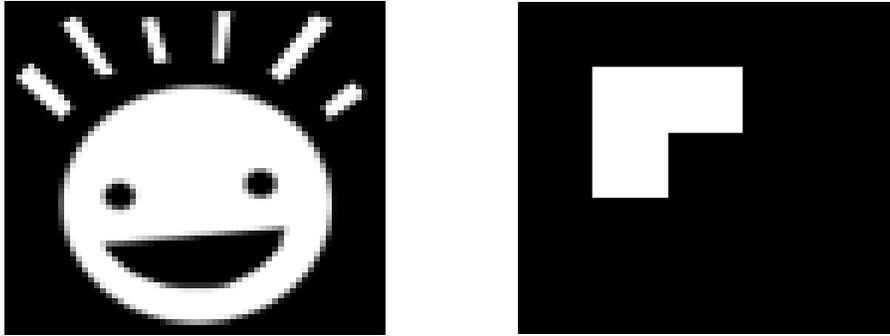


Figure (3) Binary Images.

2. Gray Scale Image

Gray _scale images are referred to as monochrome, or one-color image. They contain brightness information only brightness information only, no color information. The number of different brightness level available. The typical image contains 8 bit/ pixel (data, which allows us to have (0-255) different brightness (gray) levels. The 8 bit representation is typically due to the fact that the byte, which corresponds to 8-bit of data, is the standard small unit in the world of digital computer.



Figure (4) Gray Scale Images.

3. Color Image

Color image can be modeled as three band monochrome image data, where each band of the data corresponds to a different color.



Figure (5) Color Images.

Typical color images are represented as red, green, and blue or RGB images. Using the 8-bit monochrome standard as a model, the corresponding color image would have 24 bit/pixel – 8 bit for each color band (red, green and blue). The following figure we see a representation of a typical RGB color image. The following figure illustrate that in addition to referring to a row or column as a vector, we can refer to a single pixel red, green, and blue values as a color pixel vector (R, G, B) .

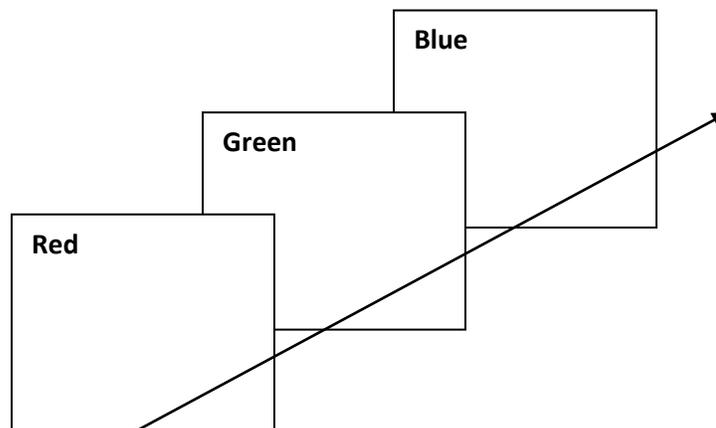


Figure (6) A color pixel vector consists of the red, green and blue pixel values (R, G, B) at one given row/column pixel coordinate (r, c) [1].

For many applications, RGB color information is transformed into mathematical space that decouples the brightness information from the color information.

The hue/saturation /lightness (HSL) color transform allows us to describe colors in terms that we can more readily understand.

The lightness is the brightness of the color, and the hue is what we normally think of as “color” and the hue (ex: green, blue, red, and orange).

The saturation is a measure of how much white is in the color (ex: Pink is red with more white, so it is less saturated than a pure red).

[Most people relate to this method for describing color].

Example: “a deep, bright orange” would have a large intensity (“bright”), a hue of “orange”, and a high value of saturation (“deep”).we can picture this color in our minds, but if we defined this color in terms of its RGB components, $R=245$, $G=110$ and $B=20$.

4. Multispectral Images

Multispectral images typically contain information outside the normal human perceptual range. This may **include** infrared, ultraviolet, X-ray, acoustic, radar data. These are not images in the usual sense because the information represented is not directly visible by the human system.

However, the information is often represented in visual form by mapping the different spectral bands to RGB components. If more than three bands of information are in the multispectral image, the dimensionality is reduced by applying a principal component's transform.

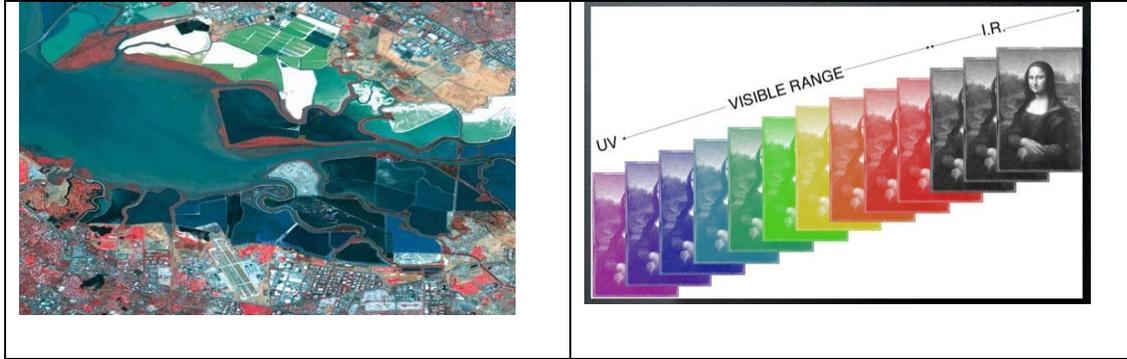


Figure (7) Multispectral images .

As the amount of data that needs to be transmitted, stored, and processed increases, the importance of topics such as compression becomes more and more apparent.

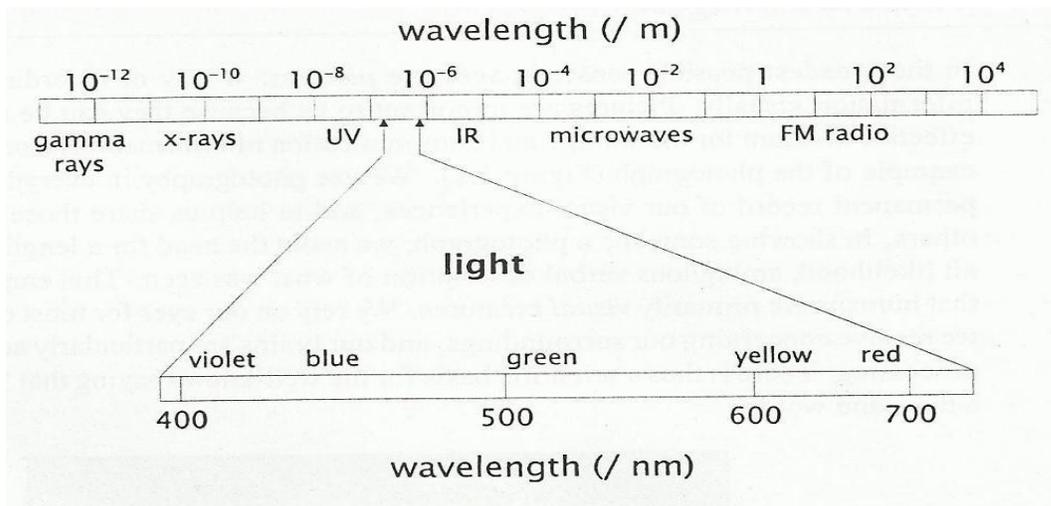


Figure (8) the spectrum of electromagnetic radiation

Popular File Formats

There are different file formats such as:-

1)Image File Format :

a) BMP format:

It is the format used by the windows, it's a compressed format and the data of image are located in the field of data while there are two fields , one for header (54 byte) that contains the image information such as (height ,width , no. of bits per pixel, no of bands , the file type).

The second field is the color map or color palette for gray level image, where its length is 0-255).

b) TIFF(Tagged Image File Format) and GIF(Graphics Interchange Format):

They are used on World Wide Web (WWW). TIFF can store many different types of image: 1-bit, grayscale, 8-bit color, 24-bit RGB, etc.

GIF files are limited to a maximum of 8 bits/pixel and allows for a type of compression called LZW. The GIF image header is 13 byte long & contains basic information.

c) JPEG (Joint photo Graphic Experts Group):

It is simply becoming standard that allows images compressed algorithms to be used in many different computer platforms.

JPEG images compression is being used extensively on the WWW. It's, flexible, so it can create large files with excellent image equality.

d) PNG format:

e) Standing for **Portable Network Graphics** meant to supersede the GIF standard, and extends it in important ways. • Special features of PNG files include:

1. Support for up to 48 bits of color information a large increase.
2. Files may contain gamma-correction information for correct display of color images, as well as alpha-channel information for such uses as control of transparency.
3. The display progressively displays pixels in a 2-dimensional fashion by showing a few pixels at a time over seven passes through each 8×8 block of an image.

f) **EXIF** (Exchange Image File) is an image format for digital cameras:

- 1) Compressed EXIF files use the baseline JPEG format.
- 2) A variety of tags (many more than in TIFF) are available to facilitate higher quality printing, since information about the camera and picture-taking conditions (flash, exposure, light source, white balance, type of scene, etc.) can be stored and used by printers for possible color correction algorithms.
3. The EXIF standard also includes specification of file format for audio that accompanies digital images. As well, it also support tags for information needed for conversion to Flash Pix (initially developed by Kodak).

2) Graphics Animation Files

A few dominant formats aimed at storing graphics animations (i.e., series of drawings or graphic illustrations) as opposed to video (i.e., series of images).

Difference: animations are considerably less demanding of resources than video files.

3) PS and PDF file format

Postscript is an important language for typesetting, and many high-end printers have a Postscript interpreter built into them.

Postscript is a vector-based picture language, rather than pixel-based: page element definitions are essentially in terms of vectors.

Another text + figures language has begun to supersede or at least parallel Postscript: Adobe Systems includes Portable Document Format (**PDF**) file format.

4) Microsoft Windows: WMF:

The native vector file format for the Microsoft Windows operating environment:

1. Consist of a collection of GDI (Graphics Device Interface) function calls, also native to the Windows environment.
2. When a WMF file is “played” (typically using the Windows PlayMetaFile() function) the described graphics is rendered.
3. WMF files are ostensibly device-independent and are unlimited in size.

5) Microsoft Windows: BMP:

The major system standard graphics file format for Microsoft Windows, used in Microsoft Paint and other programs. Many sub-variants within the BMP standard.

COLOR SPACE AND TRANSFORMATION

A number of color spaces or color models have been suggested and each one of them has a specific color coordinate system and each point in the color space represents only one specific color. Each color model may be useful for specific applications.

Typical color images, particularly those generated by a digital imaging system, are represented as red, green, blue and are normally called RGB images. They are useful for color monitors, and video cameras.

An RGB color image, represented by 8 bits of R, G, and B pixels has 256^3 or 16,777,216 colors. There are a number of such color spaces like CMYK, HSV, HIS, or LUV, etc.

1) CMYK space

Another interesting color model utilizes CMYK (cyan, magenta, yellow, and black) and this model finds utility in color printers. Most of the output devices including color printers or copiers use CMY color model. Just as the primary additive colors are red, green and blue, the primary colors of pigments on the other hand are magenta, cyan and yellow and the corresponding secondary colors are red, green and blue. The conversion from RGB to CMY may be performed as

$$\begin{bmatrix} C \\ M \\ Y \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} - \begin{bmatrix} R \\ G \\ B \end{bmatrix}.$$

2) NTSC or YIQ Color Space

In this color space (also known as YIQ color space), the luminance information Y represents the gray scale information, while hue (I) and saturation (Q) carry the color information.

The conversion from RGB to YIQ is

$$\begin{bmatrix} Y \\ I \\ Q \end{bmatrix} = \begin{bmatrix} .299 & .587 & .114 \\ .596 & -.274 & -.322 \\ .211 & -.523 & .312 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}.$$

The elements of the first row when added become unity and the elements in the second and third row sum to 0. Thus in a gray scale image, where $R = G = B$, the color components I and Q are zero. The NTSC color space is used in television.

3) $YCbCr$ Color Space

In this color space, Y is the luminous component while C_b and C_r , provide the color information. The color information is stored as two color difference components C_b and C_r . This color space is used in digital video. The information from RGB to $YCbCr$, is as follows:

$$\begin{bmatrix} Y \\ C_b \\ C_r \end{bmatrix} = \begin{bmatrix} 16 \\ 128 \\ 128 \end{bmatrix} + \begin{bmatrix} 65.481 & 128.553 & 24.966 \\ -37.797 & -74.203 & 112.00 \\ 112.00 & -93.786 & -18.214 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

Image Analysis

Image analysis involves manipulating the image data to determine exactly the information necessary to help solve a computer imaging problem. This analysis is typically part of a larger process, is iterative in nature and allows us to answer application specific questions: Do we need color information? Do we need to transform the image data into the frequency domain? Do we need to segment the image to find object information? What are the important features of the image?

Image analysis is primarily data reduction process. As we have seen, images contain enormous amount of data, typically on the order hundreds of kilobytes or even megabytes. Often much of this information is not necessary to solve a specific computer imaging problem, so primary part of the image analysis task is to determine exactly what information is necessary.

Image analysis is used both computer vision and image processing.

- For computer vision, the end product is typically the extraction of high-level information for computer analysis or manipulation. This high level information may include shape parameter to control a robotics manipulator or color and texture features to help in diagnosis of a skin tumor.
- In image processing application, image analysis methods may be used to help determine the type of processing required and the specific parameters needed for that processing. For example, determine the degradation function for an image restoration procedure, developing an enhancement algorithm and determining exactly what information is visually important for image compression methods.

System Model

The image analysis process can be broken down into three primary stages:

1. Preprocessing.
2. Data Reduction.
3. Features Analysis.

1. Preprocessing:

The preprocessing algorithm, techniques and operators are use to perform initial processing that makes the primary data reduction and analysis task easier. They include operations related to:

- 1) Extracting regions of interest.
- 2) Performing basic algebraic operation on image.
- 3) Enhancing specific image features.
- 4) Reducing data in resolution and brightness.

2. Data Reduction:

Involve either reducing the data in the spatial domain or transforming it into another domain called the frequency domain, and then extraction features for the analysis process.

3. Features Analysis:

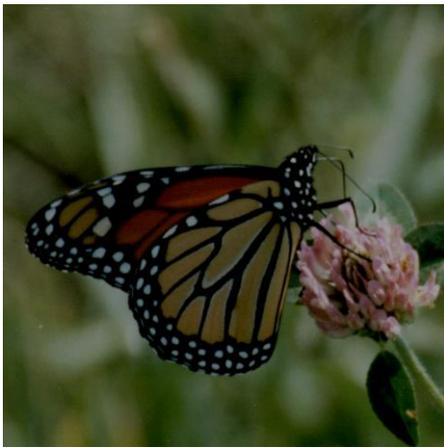
The features extracted by the data reduction process are examine and evaluated for their use in the application.

After preprocessing we can perform segmentation on the image in the spatial domain or convert it into the frequency domain via a mathematical transform. After these processes we may choose to filter the image. This filtering process further reduces the data and allows us to extract the feature that we may require for analysis.

Image Enhancement

Involve taking an image and improving it visually, typically by taking advantages of human Visual Systems responses. One of the simplest enhancement techniques is to simply stretch the contrast of an image.

Enhancement methods tend to be problem specific. For example, a method that is used to enhance satellite images may not suitable for enhancing medical images.



a. image with poor contrast



b. Image enhancement contrast stretching

Animation

Animation is the art of creating an illusion of movement from a series of still drawings.

Traditional Methods of Animation

Before the advent of computer animation, all the frames in animation had to be drawn by hand. Considering that each second of animation contains 24 frames (film), one can imagine the tremendous amount of work that had to go into creating even the shortest of animated films!

Different techniques were developed for creating animation by hand.

These are:

- 1) Key frames
- 2) Cel animation
- 3) Rotascoping

Considering the immense amount of work that has to go into the making of an animation sequence, the drawing or painting is usually done by more than one person.

- 1) **Key frames** After a storyboard has been laid out, the senior artists go and draw the major frames of the animation, known as *key frames*. These frames are then reviewed and modified. These are the key points of the animation. Later, a bunch of junior artists draw in the frames in between. This way, the workload is distributed and controlled by the key frames. By doing work this way, the time in which animation can be produced is reduced dramatically, depending on the number of people working on the project. Work can be done simultaneously by many people, thus reducing the time needed to get a final product out.
- 2) **Cel animation** is another process of creating animations. In creating animation using this method, each character is drawn on a separate piece of transparent paper. A background is also drawn on a separate piece of opaque paper. When it comes to shooting the animation, the different characters are overlaid on top of the background in each frame. This method also saves time in that the artists do not have to draw entire frames, but rather just the parts that need to change such as individual characters. Sometimes, even separate parts of a character's body are placed on separate pieces of transparent paper. In classic animation (what you see in old Disney films) each moving element is drawn on a transparent sheet of celluloid. The cel is

placed over the background and is repositioned during the course of an animation sequence to simulate movement.

- 3) **Rotascoping** is the process of copying images from moving video to create animation. For example, assume that you want to animate a pig running. It is a lot easier to draw the motion and shape of the pig in different parts of the animation when you have some reference, such as video, as opposed to imagining it. With the help of rotascoping, one can animate some complex scenes that would be very hard to visualize. One disadvantage of rotascoping is that you have to get the exact video you want to animate. For example, if you want a pig running across the screen, video of a pig running from the top of the screen to the bottom of the screen will not do.

All these animation techniques are great, but when they are most useful is when they are all used together. Cel animation by itself would not help much if it was not for the key frames and the ability to distribute the workload across many people.

Introduction to Digital Audio

The sound heard by the ear (also called audio) is analog in nature and is a continuous waveform. Acoustic instruments produce analog sounds. A computer needs to transfer the analog sound wave into its digital representation, consisting of discrete numbers.

A microphone converts the sound waves into electrical signals. This signal is then amplified, filtered, and sent to an analog-to-digital converter. This information can then be retrieved and edited using a computer. If you want to output this data as sound, the stream of data is sent to the speakers via a digital-to-analog converter, a reconstruction filter, and the audio is amplified. This produces the analog sound wave that we hear.

SAMPLING

The audio input from a source is sampled several thousand times per second. Each sample is a snapshot of the original signal at a particular time.

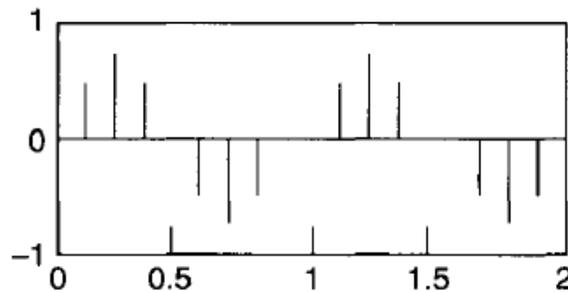


Figure 1:Sampled and digitized signal.

SAMPLING RATE

When sampling a sound, the computer processes snapshots of the waveform. The frequency of these snapshots is called the *sampling rate*. The rate can vary typically from 5000- 90,000 samples per second.

DIGITIZATION

Digitization is the process of assigning a discrete value to each of the sampled values. It is performed by an Integrated Chip (IC) called an A to D Converter. In the case of 8-bit digitization, this value is between 0 and 255 (or -128 and 127). In 16-bit digitization, this value is between 0 and 65,535 (or -32,768 and 32,767). An essential thing to remember is that a digitized signal can take only certain (discrete) values. The process of digitization introduces noise in a signal. This is related to the number of bits per sample. A higher number of bits used to store the sampled value leads to a more accurate sample, with less noise.

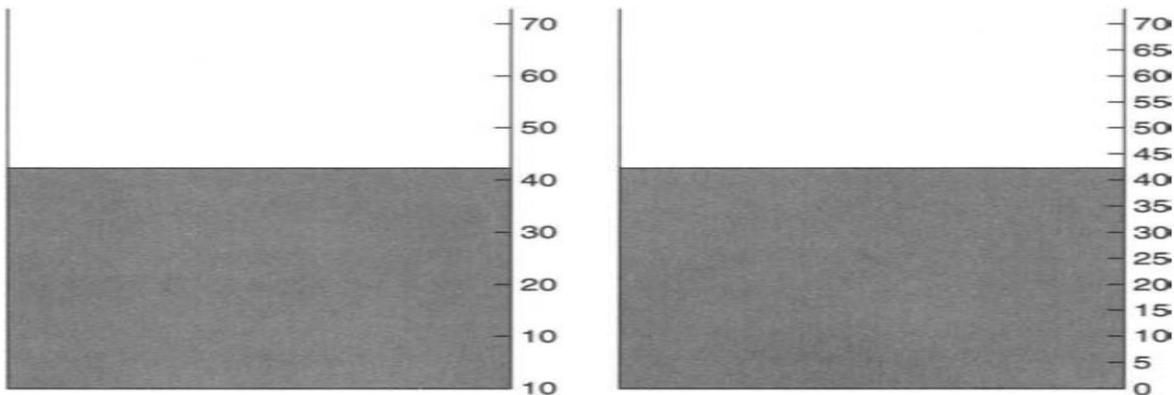


Figure 2: A smaller measure means more accurate reading.

There are two types of recording such as:-

- 1) Stereo recordings are made by recording on two channels, and are lifelike and realistic.
- 2) Mono sounds are less realistic, flat, and not as dramatic, but they have a smaller file size.

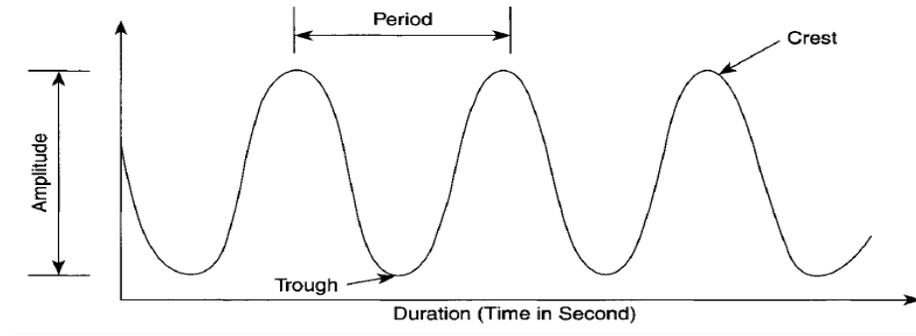
Stereo sounds require twice the space as compared to mono recordings. To calculate the storage space required, the following formula are used:

Mono Recording:

File size = Sampling rate x duration of recording in seconds x (bits per sample/8) x 1

Stereo Recording:

File size = Sampling rate x duration of recording in seconds x (bits per sample/8) x 2



Figur3:Sound of Wave

Sound File Attributes**1) Hz?**

Hz, pronounced “Hertz” is a kind of measurement. Hz measures cycles of something happening. If a sound wave goes up and down, that’s one Hz.

Directly translated into sound, a Hz is one vibration.

A standard music CD holds sound at a level of 44,100 Hz. This means that the sound can change, or vibrate, 44,100 times every second.

2) Bit Rate

“Bit” means binary digit, and is numerically represented by a zero or a one. Computers use zeros and ones to make up their whole language. When referring to sound, bits are used to tell the computer how much electricity to feed into your speakers to create a vibration. The level of electrical signal dictates the height of each wave. If you used two bits, you would be able to come up with four different levels to describe the signal strength of each sound wave (Hz):

00, 01, 11, 10

Standard music CD’s use 16 bit sound, which means that 16 zeros and ones are used to describe the level (height) of each sound wave.

Sound File Types

Sounds, like other computer files, can be saved in different formats. You'll learn how to create sounds in each of the following formats.

1) WAV

WAV is a sound file developed by Microsoft for use on windows based machines. WAV is also the file format for standard music CDs. The WAV file uses interesting algorithms to compress raw sound without a loss in quality.

2) AIFF

Originally developed by Apple, the "Audio Interchange File Format" is mostly used by Silicon Graphics and Macintosh machines.

AIFF files are easily converted to other file formats, but can be quite large. One minute of 16-bit stereo audio sampled at 44.1kHz usually takes up about 10 megabytes. AIFF is often used in high end applications where storage space is not a consideration.

3) MP3

MP3 is a type of compression that can dramatically reduce file size without drastically reducing sound quality. MP3 works by, among other things, chopping off all sounds that are outside of the normal human range of hearing. You will need a sound player to listen to MP3's.

4) RealAudio

Developed by Progressive Networks, RealAudio was the first format to allow for real time streaming of music and sound over the web. Listeners are required to download the Realplayer to enjoy sound in RealAudio Format. The Realplayer can also stream video and is currently in use by millions of Internet users worldwide.

Multimedia System Sounds

You can use sound right off the bat on your computer because beep and warning sounds are available as soon as you install the operating system.

Open the Sound Control Panel to listen to your system sounds, change them, or make a new, custom sound (see Figure 4).

In Windows, system sounds are WAV files, and they reside in the Windows/Media subdirectory. System event sounds include start.wav, chimes.wav, chord.wav, ding.wav, logoff.wav, notify.wav, recycle.wav, tada.wav, and the Microsoft sound.wav that typically plays when Windows starts up.

As you can see in Figure 4, you can assign these sounds to system events such as Windows startup, warnings from other applications, or clicks outside of an open dialog box (which causes the default beep in Windows). And you can create schemes of sounds and select a particular scheme according to your mood. You can also add your own sound files and install them so they play when system events occur: place the WAV sound files into your ~\Windows\Media directory and use the Sound Control Panel to select them.

In OS X on a Macintosh, you can only change your system alert sound. Put your custom sound file (in **AIF format**) into ~/System/Library/Sounds, and then select it in the Sound preference pane.

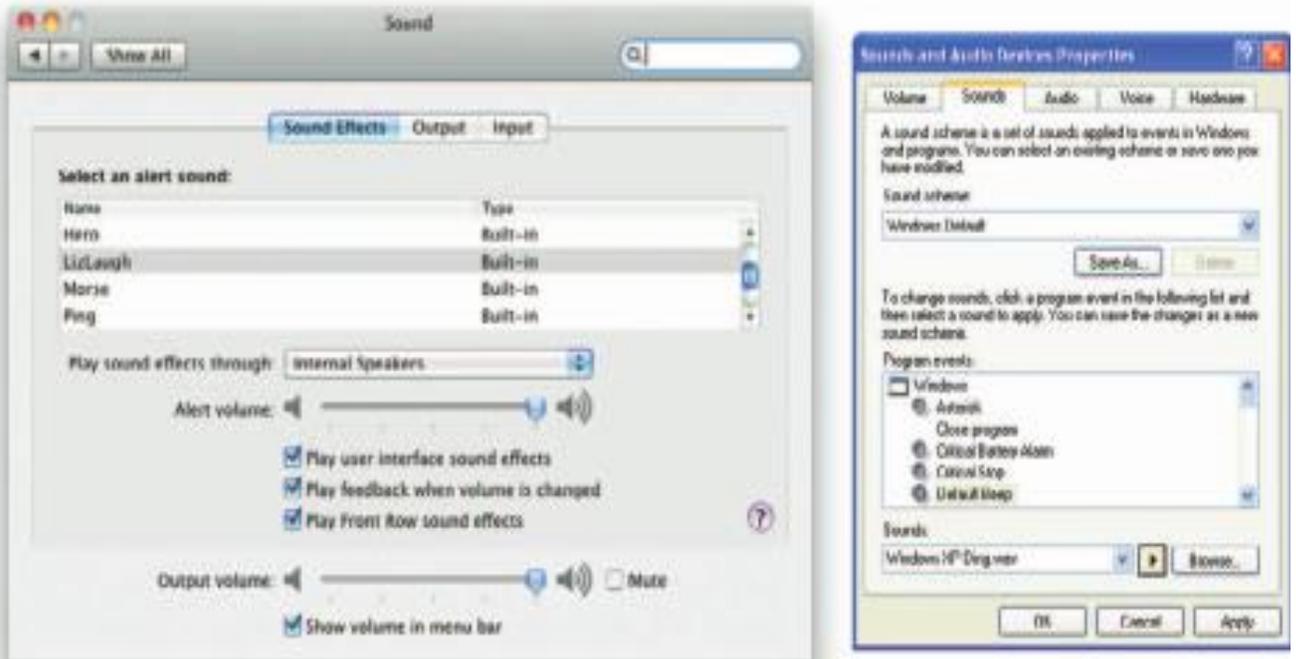


Figure 4: System Sounds

Introduction to Video

Video is a medium of communication that delivers more information per second than any other element of multimedia we have considered. We are used to seeing analog video on TV and are well aware of its impact on our life. Nowadays, a lot of video we see on TV and in movies has a digital component. For example, many of the special effects that you see in movies are digitally generated using the computer.

The DVD (Digital Video Disk or Dynamic Video Disk) makes it possible to distribute large videos in a compact form, much in the same way as the Compact Disk made the move from analog sound to digital sound easy.

Digital Video has a substantial contribution in not only movie making, but also in the gaming and IT industry.

Analog and Digital Video

Currently only analog video is used as a broadcast medium. The video that you see on TV, on Cable TV, or a VCR (Videotape Recorder) is broadcast in analog format, even though specific movies that you see may be in digital format prior to broadcasting. There are three standards worldwide for broadcasting analog video.

- 1) **NTSC** is a standard devised by the National Television System Committee and is used in the United States and Japan. This standard displays 30 (29.97 to be exact) frames per second. Each frame can contain 16 million different colors. Each full-screen frame is composed of 525 lines.
- 2) **PAL** stands for Phase Alternation by Line and is used in Europe and India. It displays 25 frames per second. Each full-screen frame is composed of 625 lines.
- 3) **SECAM** stands for Sequential Couleur Avec Memoire and is used in France. This standard displays 25 frames per second. Each full-screen frame is composed of 625 lines.

Digitization and Analog Video

The process of digitizing analog video (in PAL, NTSC, or SECAM formats) is called video capture. Video is generally captured using plug-in cards called video capture cards. Nowadays digital cameras are also available that directly store full-motion video in digital formats that can directly be copied onto a computer's hard disk. A video capture card accepts a video input from an input device such as a VCR or a video camera. Note that the audio has to be sampled through a separate cable which attaches to the sound card. The software with the video card synchronizes the two channels of audio and video.

There are some important considerations to keep in mind as you capture video. To understand these, think about what happens as you digitize video in real-time. The

video player plays the video at the rate of 30 fps. Each of those frames has to be converted into digital format and stored on the hard disk. The computer is doing several jobs in a very short interval. Thus, it is a good idea to have as much RAM as possible so that the computer is fast enough to do this large amount of processing.

File Formats for Video

After a digital video is edited, it is time to save it in a particular file format. For the PC, the AVI format is used, and for the Macintosh, the Quicktime format is used.

1) AVI (Audio Video Interleave)

The AVI format was developed by Microsoft to play videos in the Windows environment. The greatest advantage of this standard is the support provided by Microsoft. AVI supports color resolutions from 256 colors to millions of colors. It can support sound from 5 kHz Mono to CD quality stereo sound. It can deliver video at rates as low as 0.03 MB/sec and as high as 0.3 MB/sec. An editing suite or conversion programs available on the Internet can be used to convert between .AVI and other video and graphics formats.

2) QuickTime

Quicktime was developed and supported by Apple Computers and was one of the first digital video formats for the Macintosh computers. This was the first format available for PCs and the Macintosh. It is similar to the AVI format. Both use similar strategies for compression and decompression of video information. However, Quicktime is not limited to just the Macintosh platform and can be viewed on almost every platform available today.

Compression

An important aspect of communication is transfer of data from the creator to the recipient.

Compression in computer terms means reducing the physical size of data such that it occupies less storage space and memory. Compressed files are, therefore, easier to transfer because there is a sizable amount of reduction in the size of data to be transferred. This results in a reduction in the time needed for file transfer as well as a reduction in the bandwidth utilization thus providing good sound quality even over a slow network.

As many applications exchange multimedia data using communication networks, the compatibility of compression is required. Standards like CCITT (International Consultative Committee for Telephone and Telegraph), ISO (International Standard Organization), and MPEG (Moving Picture Experts Group) are used to achieve this compatibility.

Compressions in multimedia systems are subjected to certain constraints. These constraints are:

- 1) The quality of the reproduced data should be adequate for applications.
- 2) The complexity of the technique used should be minimal, to make a cost effective compression technique.
- 3) The processing of the algorithm should not take too long.
- 4) Various audio data rates should be supported. Thus, depending on specific system conditions the data rates can be adjusted.
- 5) It should be possible to generate data on one multimedia system and reproduce data on another system. The compression technique should be compatible with various reproduction systems.

Common Compression Methods

An array of compression techniques has been set by the CCITT Group an international organization that develops communication standards known as "Recommendations" for all digitally controlled forms of communication.

There are two types of compression:

- 1) Lossless Compression
- 2) Lossy Compression

1) Lossless Compression

In lossless compression, data are not altered or lost in the process of compression or decompression. Decompression produces a replica of the compressed object. This compression technique is used for text documents, databases, and text-related objects. The following are some of the commonly used lossless standards:

- 1) Pack bits encoding (**run-length encoding**)
- 2) **CCITT Group 3 1-D** (compression standard based on run-length encoding scheme)
- 3) **CCITT Group 3 2-D** (compression standard based on run-length encoding scheme modified by two-dimensional encoding)
- 4) **CCITT Group 4** (compression standards based on two-dimensional compression)
- 5) **Lempel-Ziv and Welch algorithm LZW**

2) Lossy Compression

There is loss of some information when lossy compression is used. The loss of this data is such that the object looks more or less like the original. This method is used where absolute data accuracy is not essential. Lossy compression is the most commonly used compression type. This compression technique is used for image documents, audio, and video objects.

The following are some of the commonly used lossy standards:

- 1) **Joint Photographic Experts Group (JPEG)**
- 2) **Motion Picture Experts Group (MPEG)**
- 3) **Adaptive Differential Pulse Code Modulation (ADPCM)**
- 4) **CCITT Video Coding Algorithm**
- 5) **Intel DVI (Digital Video Interactive)**

Image Compression

Involve reducing the typically massive amount of data needed to represent an image. This done by eliminating data that are visually unnecessary and by taking advantage of the redundancy that is inherent in most images. Image processing systems are used in many and various types of environments, such as:

1. Medical community
2. Computer – Aided Design
3. Virtual Reality
4. Image Processing.



**a. Image before compression
(92) KB**



**b. Image after compression
(6.59)KB**

Figure 1: Image Compression.

Image Compression Techniques

Using appropriate compression technologies is important in the context of digital graphics. This is especially true for graphics used on the Internet, since download time goes up drastically with increasing file size. Again, it is important that while the image is compressed, the quality of the image does not suffer. While many compression algorithms are available, there are two types of common compression methods that are widely used on the Internet such as JPEG and GIF .Both JPEG and GIF support an interesting feature that is especially useful when they are used in Web pages. For example, GIFs can be saved so that they appear "interlaced."

1) JPEG (Joint Photographic Experts Group)

JPEG compression works well with 24-bits image. JPEG is desirable, and for cartoons containing at most 256 colors.

Strengths of JPEG Compression

- 1) It provides support for full 24-bit color images. In contrast, GIF only supports 8-bit images.
- 2) The compressed image size and image quality trade-off can be user determined.
- 3) It is ideally suited to images of real-world scenes or complex computer-generated images.
- 4) It is platform independent for displaying 24-bit images.
- 5) It is quite good for compressing photographs.

Weaknesses of JPEG Compression

- 1) JPEG compression is a trade-off between degree of compression, resultant image quality, and time required for compression/decompression.
- 2) Bad quality is obtained when compressing an image with sharp edges or lines (as in text).
- 3) It is not suitable for 2-bit black and white images.
- 4) The degree of compression is greater for full color images than it is for gray scale images.
- 5) It is not intended for moving images/video.

2) GIF (Graphics Interchange Format)

GIF is a format that only supports 8 bits of color information. Thus for images that contain many colors (such as photographs).

Strengths of GIF Compression

- 1) It is lossless for 8-bit images.
- 2) It is ideally suited to images such as line drawings, those containing a limited number of colors, and for images containing text.
- 3) It is preferred for Vector Graphics over the Internet.
- 4) Animated GIFs are easy to make by using GIF constructing packages such as Animation Shop (this comes packaged with Paint Shop Pro).

Weaknesses of GIF Compression

- 1) GIF is not suitable for 24-bit images. When compressing such images, much of the color information is lost due to the reduction of color depth.
- 2) The compression ratios are low.

Audio Compression Requirements

In the case of audio, processing data in a multimedia system leads to storage requirements in the range of several megabytes.

Schemes of Audio Compression

The most commonly used compression schemes for audio are:

1) ADPCM (Adaptive Differential Pulse Code Modulation)

ADPCM stands for Adaptive Differential Pulse Code Modulation. It is a family of speech compression and decompression algorithms. Using this technique one can achieve about 40-80% compression.

Audio signals are waves, which are smooth in nature. Complex sounds, such as music, consist of a series of overlaid waves at different frequencies. These wave patterns have amplitudes of the signal that change with time. Digital encoding of the signal is achieved by sampling the audio signal at different frequencies.

2) MPEG (Motion Picture Experts Group)

MPEG stands for Motion Picture Experts Group. In 1987, a very powerful algorithm was developed that was standardized as ISO-MPEG Audio. Using MPEG audio coding you can compress the original audio on a CD by a factor of 12 without losing the sound quality. Factors of 24 or even more are also possible, but these are achieved only by getting a sound output of reduced sampling rate and reduced resolution of the samples.

Video Compression

Since digital video files are extremely large, these not only take a large amount of disk space, but also require high data transfer rates (from hard disk to screen) for playback. It is, therefore, recommended that during video capture, some lossless compression technique be used. As a compressed video file is played, it is decompressed.

Compression and decompression is even more important if the movie is to play off of a CD-ROM drive, since the reading of data is comparatively slower from a CD than from the hard drive.

Several compression/decompression (codec) algorithms are available for compressing digital videos. Codec can be software-based, hardware-based, or both. Hardware-based compression is significantly faster than software compression, because the hardware is dedicated to compression. The codec you choose affects the visual quality of the movie as well as the speed with which it plays on the monitor.

An important feature of codec is whether they are Asymmetric or Symmetric.

- 1) **A Symmetric codec** takes approximately the same time to compress as it takes to decompress data.
- 2) **An Asymmetric codec** usually takes longer to encode video than it does to decode. An Asymmetric codec generally delivers significantly better playback performance than a symmetric codec.

Schemes of video Compression(Windows-Based Compressors)

The following software compressors come packaged with MS-Video for Windows (VfW):

- 1) **Microsoft Video1 codec**—This compressor is best used in converting analog video into digital format. This is a lossy compressor and supports color depth of 8 bits (256 colors) or 16 bits (65,536 colors).
- 2) **Microsoft RLE codec**—This compressor is used often for compressing animation and computer-generated images. It supports only 256 colors.
- 3) **Cinepak codec**.This compressor is used for compressing 24 bits (or 16 million colors) for playback from the CD-ROM disk. This codec attains higher compression ratio, better image quality, and faster playback speeds than Microsoft Video 1 codecs.

Third-Parity Compressors

For many applications, it may be desirable to use specialized codecs, which are mostly hardware based. Some of these are:

- 1) **MJPEG—Motion JPEG (MJPEG)**, a digital video compressor, is an extension of the JPEG standard. It is used for compressing digital videos.
- 2) **MPEG-1**—MPEG-1 is a standard set by the Motion Picture Experts Group and is primarily used for CD-ROM video playback. It uses an extension of the lossy compression techniques involved in JPEG by predicting interframe motion.

Computer Animation

Computer animation can be done on a variety of computers. Simple cel animation requires nothing more than a computer system capable of simple graphics with proper animation software.

1) The hardware platforms used for animation are:

- a) **The SGI** (produced by Silicon Graphics, Inc.) platform is one of the most widely used hardware platforms in professional or broadcast quality computer animation productions. SGI computers are extremely fast, produce excellent results, and operate using the wide spread UNIX operating system.
- b) **PCs** are very versatile computers. Because of their combination of flexibility and power, PCs have proven to be very useful for small companies and other businesses as platforms for making computer animation. Applications such as 3D Studio and Animator Studio are used on PCs to make animations. PCs are relatively cheap and provide good quality for their price.
- c) **Macintoshes** .Macintoshes did not become widely known until recently, when newer faster models came out. Many people consider Macintosh slow and inefficient. Many companies are producing computer graphics and animation software for the Macintosh. Some of these are Adobe with products such as Photo Shop and Premiere.
- d) **Amiga** computers have held a position in the computer animation industry for a number of years. There are two software packages that Amigas are basically known for: Video Toaster and Light Wave 3D. Many television shows use Amiga for their special effects and animations.

2) The software used for animation are:

These are some of the most popular software packages used by companies, schools, and individuals around the globe:

- a) **3D Studio Max** runs on Windows. It is entirely object oriented, featuring new improvements such as volumetric lighting, space warps, and all new redesigned interfaces.
- b) **3D Studio** is a 3-D computer graphics program that runs on PCs. It is relatively easy to use. Many schools and small production studios use 3D Studio.
- c) **Light Wave 3D** is another high-end PC 3-D computer graphics software package. Light Wave 3D is used in quite a few television productions such as Babylon 5 and Sea Quest.
- d) **Animator Studio** is a Cel animation program. Animator Studio runs on Windows. It has a multitude of features that minimize the animation creation time.
- e) **Elastic Reality** is one of the top of the line morphing programs. Elastic Reality runs on Macintoshes and SGIs. One of the great features of Elastic Reality as opposed to other programs is that it uses splines as opposed to points to define the morphing area.
- f) **Softimage** is one of the topmost computer animation software packages. It is used in many top production studios around the country and the world.

Authoring Multimedia in Visual Basic

1) GRAPHICS (Pictures in Visual Basic)

Graphics formats recognized by Visual Basic include **.bmp** files (bitmaps), **.ico** files (Icons), **.rle** files (run-length encoded files), **.wmf** files (Windows Metafiles), **.emf** files (Enhanced Metafiles), **.gif** files, and **.jpg** files (JPEG's).

Pictures can be displayed in three objects in Visual Basic applications:

- 1) **On a form**
- 2) **In a picture box**
- 3) **In an image control**

You use different techniques to add a picture to a form, a picture box, or an image control depending on whether you add the picture at design time or at run time.

Adding a Picture at Design Time

There are two ways of adding a picture at design time:

- 1) Load a picture onto a form, a picture box, or an image control from a picture file by using the Picture property in the Properties Window.
- 2) Paste a picture onto a form, into a picture box, or an image control by copying a picture from another application (such as Microsoft Paint) onto the Clipboard and pasting it using the Edit menu in Visual Basic into the control.

Once you have set the Picture property for a form, picture box, or image control, the word displayed in the Settings box is "(Bitmap)," "(Icon)," or "(Metafile)." To change the setting, load or paste another picture. To set the Picture property to "(None)" again, select the word and press the DEL key.

Adding a Picture at Run Time

There are three ways of adding a picture at run time:

- 1) Use the Load Picture function to specify a file name and assign the picture to the Picture property.

The following statement loads the file Flowers.bmp into a picture box named picView:

```
picView.Picture = LoadPicture("C:\MyPicture\Flowers.bmp")
```

- 2) Use the LoadResPicture function to assign a picture from the project's resource (.res) file into the Picture property.

The following statement loads the bitmap resource ID, 10, from the resource file into a picturebox named picRes:

Set picRes.Picture = LoadResPicture(10, vbResBitmap)

- 3) Copy a picture from one object to another.

Once a picture is loaded or pasted onto a form, a picture box, or an image control, you can assign it to other forms, picture boxes, or image controls at run time. For example, this statement copies a picture from a picturebox named picSource to an image control named imgView:

Set imgView.Picture = picSource.Picture

Removing a Picture at Run Time

You can also use the LoadPicture function to remove a picture at run time without replacing it with another picture. The following statement removes a picture from an image control named imgView:

imgView.Picture = LoadPicture()

Table 1 Graphics Methods

Method	Description	Used with
Cls	Clears all graphics and Print output.	Form, PictureBox
PSet	Sets the color of an individual pixel.	Form, PictureBox
Point	Returns the RGB color value of a specified point.	Form, PictureBox
Line	Draws a line, rectangle, or filled-in box.	Form
Circle	Draws a circle, ellipse, or arc.	Form, PictureBox
PaintPicture	Paints graphics in selected area.	Form, PictureBox

Audio and Video

Visual Basic does not provide any intrinsic controls/methods for integrating audio and video into your multimedia applications. The application has to depend on ActiveX controls for managing audio and video. Fortunately, Visual Basic is shipped with scores of ActiveX controls and among them is the Microsoft Multimedia control. The Multimedia control allows you to manage Media Control Interface (MCI) devices. These MCI devices include: sound boards, MIDI sequencers, CD-ROM drives, audio players, videodisc players, and videotape recorders and players. In Figure 1, the buttons are defined, from left to right, as Prev, Next, Play, Pause, Back, Step, Stop, Record, and Eject.

Multimedia Requirements and Supported Device Types

The functions provided to you by the Multimedia control depend on the hardware and software configurations of a particular machine. For instance, if your application uses specific multimedia devices and drivers, they must be installed on the user's machine.

Driver support for many multimedia devices (audio and video files, for instance) is provided for in the Windows operating systems.

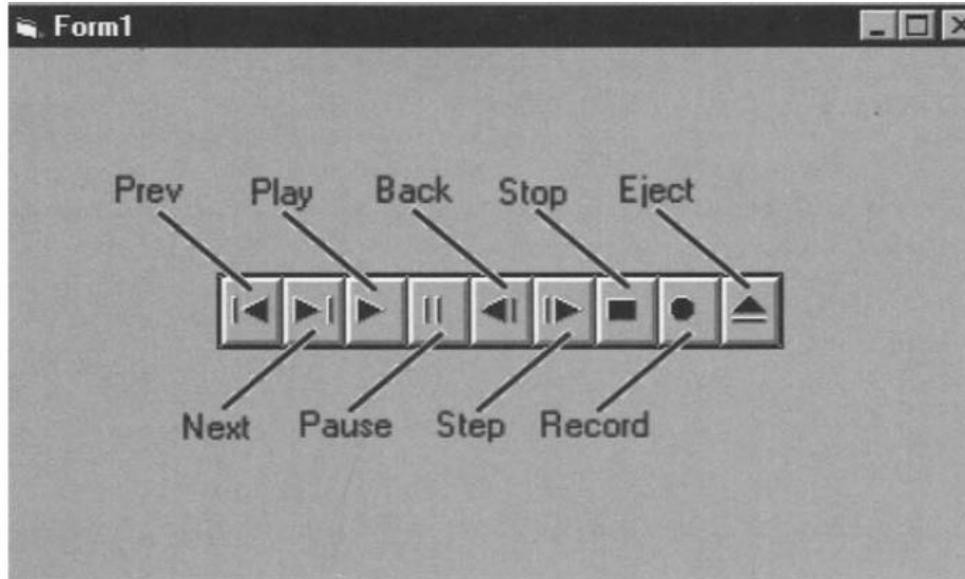


Figure 1: Microsoft multimedia control.

MCI Commands (Media Control Interface)

The Multimedia control uses a set of high-level, device-independent commands, known as Media Control Interface commands that control various multimedia devices. Many of these commands correspond directly to a button on the Multimedia control. For instance, the Play command corresponds to the Play button.

Opening the MCI Device

After you place the Multimedia control on a form, whether it is set to be visible or not, the first step is accessing the MCI device. To do this, you set a number of run-time properties.

For example:

With MMControll

.Notify = False

.Wait = True

.Shareable = False

.DeviceType = "CDAudio"

End With

- The Notify property, if set to True, generates a done event when the next command is completed. The Done event provides useful feedback indicating the success or failure of the command. The Done event is also used to synchronize the occurrence of other events based on the completion of the audio/video file.
- The Wait property determines whether or not the Multimedia control waits for the next command to complete before returning control to the application.
- The Shareable property either restricts or allows use of the media device by other applications or processes.
- The DeviceType property is used to specify the type of MCI device.
- Finally, the Open command is used to open the MCI device:

MMControl.Command = "Open"

When the control is visible, setting the properties and issuing the Open command enables the push buttons of the Multimedia control that are inherently supported by the MCI device. For instance, opening the CDaudio device enables the Prev, Next, Play, and Eject buttons. When Play button is pressed, the Stop and Pause buttons are enabled.

Visual Basic code for playing audio looks like:

With MMControl

.Notify = False

.Wait = TRUE

.Shareable = FALSE

.DeviceType = "WaveAudio"

.FileName = "C:\WINDOWS\MEDIA\TADA.WAV"

.Command = "Open"

.Command = "Play"

End With

On the other hand, video is played slightly different using the Multimedia control. The output of a video is visual and, therefore, has to be displayed in a window. You can use the

hwn Display property to specify the handle to such a window. If no handle is specified in the hWndDisplay property, as is the default setting, the Multimedia control plays the video in its own window known as the Stage Window. If you need to embed the video in your application's window, then you can use the form or a control like picture box to do so.

In the example below, a picture box named pic Video is being used to display the video whose handle is assigned to the hWndDisplay property.

With MMControll

.Command = "Close"

.Notify = False

.Wait = TRUE

.Shareable = FALSE

.DeviceType = "AVIVideo"

.Filename = "C:\WINDOWS\HELP\EXPLORER.AVI"

Provide a handle for video output

.hWndDisplay = picVideo.hWnd

.Command = "Open"

.Command = "Play"

End With

You should always close those MCI devices that are open before exiting your application. **Form1.MMControll.Command = "Close"**

Virtual Reality

Virtual reality (VR) is a computer interface that maximizes our natural perception abilities. Static two-dimensional images are often deceiving; it may be hard to reconstruct scales and distances between objects. Thus, it is important to implement the third dimension and to bring depth to objects.

VR use separate images for the right and left eyes. Pre-determined movement is implemented using a movie or animated image.

Arbitrary user-defined movement is implemented using the Virtual Reality Modeling Language (VRML) which is a standard language for describing interactive 3-D objects and worlds delivered across the Internet.

VRML-images can be rotated and magnified interactively.

Best virtual reality implements both movement and stereoscopy. However, at this point you can view it only using special graphical computers (SGI).

Virtual Reality in the Web

Virtual reality has greatly changed the way in which people are able to interact with and manipulate information. The technology is, in fact, an outgrowth of earlier generations of computing, and some of its core components have been in use for some time. It is a natural outcome of the continued development of computer technology, including the availability of larger random access memory (RAM), faster processing speed, higher capacity storage media, diverse input interfaces, assorted multimedia peripherals such as digital cameras, sound and graphics cards and high speed CDROMs, and a burgeoning software industry that is scrambling to develop more realistic 3-D applications.

Applications

Virtual reality technology has a variety of applications. In home, school, navy, and any other places in the world, we can use a VR system for entertainment, simulation, and education.

- 1) **Entertainment Chat.** We can meet and chat with people from all over the globe. Virtual chat site is filled with thousands of fun and interesting people to chat with.

Generally, each person has his/her own avatar. An avatar is a 3D representation of you that other people can see when you are chatting. Avatars even have the ability to run, jump, fly, dance, and express a whole host of emotions and actions.



Figure 1: Entertainment Chat

- 2) **Game .** From marathon trivia games to league bowling nites, there are many sites to provide dozens of creative gaming environments such as soccer, hockey, bowling, chess, checkers, bingo, etc.



Figure 2: Game

- 3) **Shopping** . You can buy anything at a "real" 3D virtual mall in cyberspace, which is designed to resemble a modern shopping mall. The malls have a variety of vendors of both traditional and virtual products and services.

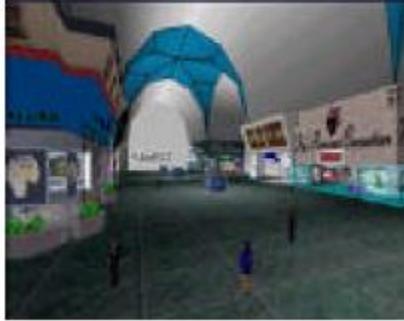


Figure 3: Shopping

- 4) **Build and Explore**. In a virtual reality site, you can build anything you want. A nice house in the country has an impenetrable fortress, or even a space ship. The only limit is your imagination.



Figure 4: Build and Explore

Computer and Multimedia Networks

Computer network are essential to the modern computing environment. networks are share all major and technologies of computer networks.

Basics of Computer and Multimedia Networks

It has been recognized that network communication is a complex task that involves multiple levels of protocols. A multilayer protocol architecture was proposed by

the international organization for standardization (ISO) in 1984, called Open System Interconnection(OSI), documented by ISO.

The OSI Reference Model

The OSI Reference Model has the following network layers:-

1) Physical Layer:-

- a) Defines electrical and mechanical properties of the physical interface (e.g., signal level, specification of the connections, etc).
- b) Specifies the functions and procedural sequence performed by circuits of physical interface.

2) Data Link Layer:- specifies the ways to establish, maintain, and terminate a link such as

- a) Transmission and synchronization of data frames.
- b) Error detection and correction.
- c) Access protocol to the physical layer

3) Network Layer:-

- a) Defines the routing of data from one end to the other across the network such as circuit switching or packet switching.
- b) Provides services such as addressing internetworking, error handling, congestion control, and sequencing of packets.

4) Transport layer:-

- a) Provides end to end communication between end systems that support end-user application of services.
- b) Supports either connection oriented or connectionless protocol.
- c) Provides error recovery and flow control.

5) Session Layer:-

- a) Coordinates interaction between user applications on different hosts.
- b) Manages session (connections), such as completion of long file transfer.

6) **Presentation Layer:-**deals with the syntax of transmitted data such as conversion of different data formats and code due to different conventions, compression, or encryption.

7) **Application Layer:-**supports various application programs and protocols such as FTP and HTTP and so on.

TCP/IP Protocols

The OSI protocol architecture although instrumental in the development of computer network didn't gain full acceptance due largely to the competing and more practical TCP/IP set of protocol. TCP/IP protocol was developed before OSI and was founded mostly by the U.S. Department of Defense. They become the standard after their adoption by the Internet.

OSI	TCP/IP
Application Layer	Application (e.g.FTP,HTTP)
Presentation Layer	Transport (e.g.TCP(connection – oriented),UDP(connectionless))
Session Layer	Internet (IP)
Transport Layer	Network Access (e.g.Ethernet)
Network Layer	Physical (e.g. Fiber Channel)
Data Link Layer	
Physical Layer	

Transport Layer:-TCP and UDP are transport layer protocols used in TCP/IP to facilitate host to host (or peer to peer) communication.

- 1) **Transmission Control Protocol (TCP).**TCP is connection-oriented: it provides reliable transfer between pairs of communicating process across the network. It handles the sending of application data to the destination process.

TCP relies on the IP layer for delivering the message to the destination computer specified by its IP address. It provides message packetizing, error detection, and retransmission, packet resequencing, and multiplexing.

- 2) **User Datagram Protocol (UDP):-**UDP is connectionless, the message to be sent is a single datagram .if the message is too long or requires guaranteed delivery, it will have to be handled by application layer. Essentially the only thing UDP provides is multiplexing and error detection through a checksum. Although UDP data transmission is much faster than TCP, it is unreliable, especially in a congested network.

Multimedia Network Communication and Applications

A multimedia network communication and traditional computer network communication are similar, since them both deal with data communication. However, challenges in multimedia network communications arise because data (audio, video, etc) are known as continuous media. They have the following characteristics:-

- 1) **Voluminous:-**they demand high rates, possibly dozens or hundreds of Mbps.

- 2) **Real-Time and Interactive**:-they demand low delay and synchronization between audio and video. In addition, applications such as videoconferencing and interactive multimedia require two-way traffic.
- 3) **Sometimes Bursty**:- data rates fluctuate drastically, for example video on demand ,no traffic most of the time but burst to high volume.

Quality of Multimedia Data Transmission

Quality of Service(QoS) :- *quality of multimedia data transmission* depends on many parameters. Some of the most important are:-

- 1) **Data Rate**.A measure of transmission speed,often kilobits per second(kbps) or megabis per second(Mbps).
- 2) **Latency (maximum frame/packet delay)**.Maximum time needed from transmission to reception, often measured in milliseconds (msec).in voice communication, for example ,when the round trip delay exceeds 50 msec ,echo become a noticeable problem; when the one way delay is longer than 250 msec, talker overlap will occur sine eack caller will talk without knowing the other is also talking.
- 3) **Packet loss or error**. A measure in percentage of error rate of the packetized data transmission. Packets get lost or garbled such as over the internet. They may also be delivered late or in the wrong order. Sine, retransmission is often undesirable, a simple error recovery method for real time multimedia is to replay the last packet, hoping the error is not noticeable.
- 4) **Jitter (or delay jitter)**. A measure of smoothness of the audio/video playback. Technically jitter is related to the variance of frame/packet

delays. A large buffer (jitter buffer) can hold enough frames to allow the frame with longest delay to arrive, to reduce playback jitter.

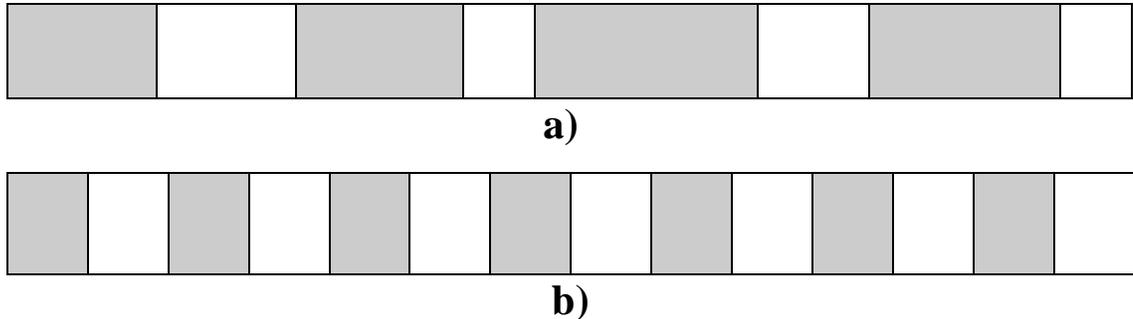


Figure 6: Jitter in frame playback: a)high jitter; b)low jitter

- 5) **Sync skew.** A measure of multimedia synchronization, often measured in milliseconds (msec). For good lip synchronization, the limit of sync skew is ± 80 msec between audio and video.

Multimedia Services Classes

Based on the above measures, multimedia applications can be classified into the following types:-

- 1) **Real-time (also conversational).** Two-way traffic, low latency and jitter, possibly with prioritized delivery, such as voice telephony.
- 2) **Priority data.** Two-way traffic, low latency and low loss with prioritized delivery such as e-commerce applications.
- 3) **Silver.** Moderate latency and jitter, strict ordering and sync. One-way traffic such as streaming video; or two-way traffic (also interactive) such as internet games.
- 4) **Best Effort (also Background).** No real-time requirement, such as downloading or transferring large files (movie).
- 5) **Bronze.** No guarantees for transmission.

Multimedia learning

Multimedia learning refers to learning from words and pictures. Multimedia instruction refers to the presentation of material using both words and pictures, with the intention of promoting learning. The case for multimedia learning rests on the premise that learners can better understand an explanation when it is presented in words and pictures than when it is presented in words alone.

- Multimedia messages can be based on the delivery media (e.g., amplified speaker and computer screen)
- Presentation mode (e.g., words and pictures).
- Sensory modalities (e.g., auditory and visual).

The design of multimedia instructional messages can be based on

- 1) **Technology-centered** approach that focuses on the capabilities of advanced technologies.
- 2) **Learner-centered** approach that focuses on the nature of the human cognitive system.

Multimedia learning may be viewed as

- 1) **Response strengthening** (in which multimedia environments are used as drill-and-practice systems.
- 2) **Information acquisition** (in which multimedia messages serve as information delivery vehicles).
- 3) **Knowledge construction** (in which multimedia messages include aids to sense-making).

Three possible learning outcomes are:-

- 1) **No learning** (as indicated by poor retention and poor transfer performance).
- 2) **Rote learning** (as indicated by good retention and poor transfer performance).
- 3) **Meaningful learning** (as indicated by good retention and good transfer performance). Meaningful learning outcomes depend on the cognitive activity of the learner during learning rather than on the learner's behavioral activity during learning.

What is Multimedia Instruction?

People learn better from words and pictures than from words alone. This straightforward statement summarizes the promise of multimedia learning. In short, I am intrigued by the idea that we can improve people's learning by incorporating effective graphics into verbal material. Does adding graphics to words help people learn better? What makes an effective graphic? How do people learn from words and pictures?

The term multimedia instruction means different things to different people.

- 1) For some people, multimedia instruction means that a person sits at a terminal and receives a presentation consisting of on-screen text, on-screen graphics or animation, and sounds coming from the computer's speakers – as with an on-line multimedia encyclopedia.
- 2) For some people, multimedia instruction means a “live” presentation in which a group of people seated in a room views images presented on one or more screens and hears music or other sounds presented via speakers.

Examples of Multimedia:-

- 1) Watching a video on a TV screen can be called a multimedia experience because both images and sounds are presented.
- 2) Another example of multimedia instruction is a PowerPoint presentation in which someone presents slides from a computer projected onto a screen and talks about each one.
- 3) Even low-tech environments allow for multimedia instruction, such as a “chalk and talk” presentation in which an instructor writes or draws on a blackboard (or uses an overhead projector) while presenting a lecture. Finally, the most basic form of multimedia instruction is a textbook lesson consisting of printed text and illustrations.

I define multimedia instruction as the presentation of material using both words and pictures, with the intention of promoting learning.

- **By words**, I mean that the material is presented in verbal form using printed or spoken text, for example.
- **By pictures**, I mean that the material is presented in pictorial form, including using static graphics such as illustrations, graphs, photos, or maps, or dynamic graphics such as animations or video.

For example, in a multimedia encyclopedia the words can be presented as on-screen text or as narration, and the pictures can be presented as graphics or animation.

In a textbook, the words can be presented as printed text and the pictures as illustrations (or other kinds of graphics).

The Case Of Multimedia Learning

An instructional message is a communication that is intended to foster learning.

In presenting an instructional message to learners, instructional designers have two main formats available **words and pictures**.

- 1) Words include speech and printed text.
- 2) Pictures include static graphics (such as illustrations or photos) and dynamic graphics (such as animations or video).

For hundreds of years, the major format for presenting instructional messages has been words – including lectures and books. In short, verbal modes of presentation have dominated the way we convey explanations to one another, and verbal learning has dominated education.

Similarly, verbal learning has been a major focus of educational research.

The advent of computer technology has enabled an explosion in the availability of visual ways of presenting material, including large libraries of static images as well as compelling dynamic images in the form of animations and video.

The case for multimedia learning is based on the idea that instructional messages should be designed in light of how the human mind works. Let's assume that humans have two information processing systems – one for verbal material and one for visual material. Let's also acknowledge that the major format for presenting instructional material is verbal. The rationale for multimedia presentations – that is, presenting material in words and pictures – is that it takes advantage of the full capacity of humans for processing information. When we present material only in the verbal mode, we are ignoring the potential contribution of our capacity to process material in the visual mode as well.

Why might two channels be better than one?

Two explanations are the quantitative rationale and the qualitative rationale.

- 1) **The quantitative rationale** is that more material can be presented on two channels than on one channel – just as more traffic can travel in two lanes than in one lane.
- 2) **The qualitative rationale** is that words and pictures while qualitatively different, can complement one another and that human understanding occurs when learners are able to mentally integrate corresponding pictorial and verbal representations.

As you can see, the qualitative rationale assumes that the two channels are not equivalent; words are more useful for presenting certain kinds of material perhaps representations that are more formal and require more effort to translate whereas pictures are more useful for presenting other kinds of material perhaps more intuitive, more natural representations.

In short, one picture is not necessarily equivalent to 1,000 words (or any number of words). To build connections between words and pictures, learners are able to create a deeper understanding than they could from words or pictures alone.

Creating a multimedia presentation (2): Practical assignment

There are five steps you will need to follow to enable you to complete this practical assignment in multimedia presentation properly.

- 1) Choose topic
- 2) Design presentation on paper
- 3) Gather information
- 4) Put presentation together
- 5) Preview

1) Topic

The topic must include the four items that make up a presentation.

- a) Text
- b) Sound
- c) Graphics
- d) Video

You must choose your topic carefully. Here are some examples:

- Family
- Pets
- Hobbies
- Sports
- Holidays
- Computer systems

Here is an example of a presentation. This presentation has three pages about computer systems although it is possible have more. There are also links to each of the pages.

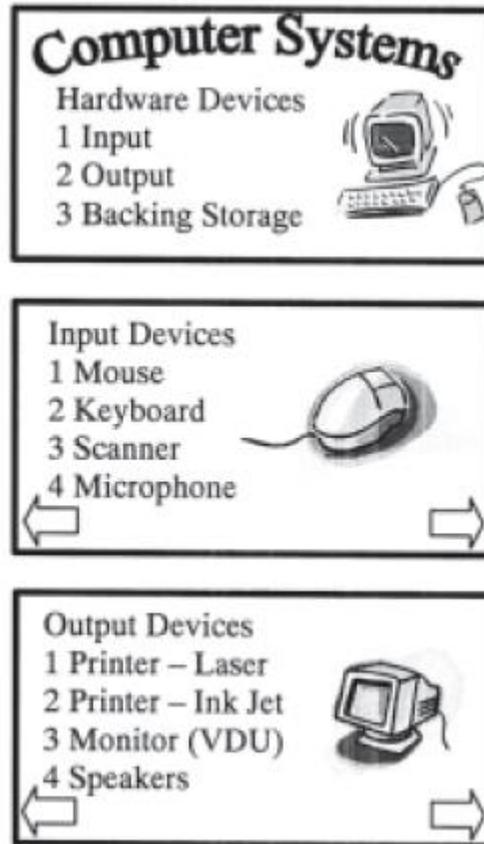


Figure 1: Presentation of Computer Systems

2) Design

It is essential that you plan your presentation properly before going anywhere near the computer.

In planning your presentation your tutor will give you planning sheets on which you should roughly indicate the layout of the presentation.

There should be a planning sheet for each page you are planning for the presentation. Remember the final presentation **must** include text, sound, video, graphics and page linking (hyperlinks).

Presentation planning of sheet 1	
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Presentation planning of sheet 2	
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Presentation planning of sheet 3	
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3) Gathering information

Now you are going to gather all the information that you will require to complete your presentation. It is important that all the information is gathered, and then saved, so that the presentation can be put together in a single operation.

Choose a topic that really interests you – this will make your presentation more interesting to complete.

You have to tell your tutor where you obtained your information from and the filename that it is saved under. You will need to fill in the grid for this part.

Remember to save the files with meaningful file names. It is possible to write the text yourself. Music can come from your own collection.

You may decide to draw your own graphics.

Video clips could be shot using a digital video camera or digital camera.

Once you have gathered all the information (text, sound, video and graphics) show them to your tutor.

Text 1		
Text 2		
Text 3		

Graphic 1		
Graphic 2		
Graphic 3		

Audio 1		
Audio 2		
Audio 3		

Video 1		
Video 2		
Video 3		

4) Putting the information together

Decide which multimedia package(s) you are going to use.

Remember

Save your work on the computer on a regular basis – it will stop there being a disappointment if the computer crashes – it is good practice to do this. You can lose hours of work if you don't. Show your final presentation to your tutor.

5) Preview

The preview steps include:-

- 1) Thought – does the presentation do exactly as you had planned?
- 2) Does the sound play properly?
- 3) Are the hyperlinks correct?
- 4) Be self-critical of your own presentation.
- 5) Could the presentation be improved if you had more time available? If so, how?
- 6) Once you are completely satisfied with your presentation, you should obtain a hard copy for your files.