UNIT III MULTIMEDIA SYSTEMS DESIGN

Multimedia basics − Multimedia applications − Multimedia system architecture −Evolving technologies for multimedia − Defining objects for multimedia systems −Multimedia data interface standards − Multimedia databases.

3.1 MULTIMEDIA BASICS

Multimedia is a combination of text, graphic art, and sound, animation and video elements.

The IBM dictionary of computing describes multimedia as "comprehensive material, presented in a combination of text, graphics, video, animation and sound. Any system that is capable of presenting multimedia, is called a multimedia system".

A multimedia application accepts input from the user by means of a keyboard, voice or pointing device. Multimedia applications involve using multimedia technology for business, education and entertainment. Multimedia is now available on standard computer platforms. It is the best way to gain attention of users and is widely used in many fields as follows:

- Home PCs equipped with CD-ROMs and game machines hooked up with TV screens have brought home entertainment to new levels. These multimedia titles viewed at home would probably be available on the multimedia highway soon
- Public places - Interactive maps at public places like libraries, museums, airports and the stand-alone terminal
- Virtual Reality (VR) - This technology helps us feel a 'real life-like' experience. Games using virtual reality effect is very popular

MULTIMEDIA ELEMENTS

High-impact multimedia applications, such as presentations, training and messaging, require the use of moving images such as video and image animation, as well as sound (from the video images as well as overlaid sound by a narrator) intermixed with document images and graphical text displays. Multimedia applications require dynamic handling of data consisting of a mix of text, voice, audio components, video components, and image animation. Integrated multimedia applications allow the user to cut sections of all or any of these components and paste them in a new document or in another application such as an animated sequence of events, a. desktop publishing system, or a spreadsheet.

The components that fall under our definition of multimedia are: '

Data elements for Multimedia Systems

Facsimile: Facsimile transmissions were the first practical means of transmitting document images over telephone lines. The basic technology, now widely used, has evolved to allow higher scanning density for better-quality fax

Document images : Document images are used for storing business documents that must be retained for long periods of time or may need to be accessed by a large number of people. Providing multimedia access to such documents removes the need for making several copies of the original for storage or *distribution*

Photographic images : Photographic images are used for a wide range of applications . such as employee records for instant identification at a security desk, real estates systems with photographs of houses in the database containing the description of houses, medical case histories, and so on.

Geographic information systems map (GIS)

Map created in a GIS system are being used wildly for natural resources and wild life management as well as urban planning. These systems store the geographical information of the map along with a database containing information relating highlighted map elements with statistical or item information such as wild life statistics or details of the floors and

rooms and workers in an office building

Voice commands and voice synthesis: Voice commands and voice synthesis are used for hands-free operations of a computer program. Voice synthesis is used for presenting the results of an action to the user in a synthesized voice. Applications such as a patient monitoring system in a surgical theatre will be prime beneficiaries of these capabilities. Voice commands allow the user to direct computer operation by spoken commands

Audio message : Annotated voice mail already uses audio or voice message as attachments to memos and documents such as maintenance manuals.

Video messages : Video messages are being used in a manner similar to annotated voice mail.

Holographic images : All of the technologies so for essentially present a flat view of information. Holographic images extend the concept of virtual reality by allowing the user to get "inside" a part, such as, an engine and view its operation from the inside.

Fractals : Fractals started as a technology in the early 1980s but have received serious attention only recently. This technology is based on synthesizing and storing algorithms that describes the information.

3.2 MULTIMEDIA APPLICATIONS

The first widely used application of multimedia is document image management. It is primarily intended for scanning documents and retaining their images.

Another application is image processing. It is also known as Image recognition. It is intended for recognizing objects by analyzing their raster images. Applications that present a view of generic multimedia applications are:

1. Document Imaging

The fundamental concepts of storage, compression and decompression, and display technologies used for multimedia systems were developed for document image management. Organizations such as insurance agencies law offices, country and state governments, and the federal government manage large volumes of documents.

Document image technology is adopted by Department of Defence for applications ranging from military personnel records to maintenance manuals and high-speed printing systems. Almost all document image system use workflows that are customized for the purpose for which they are being used. The workflow defines the sequence for scanning images, performing data *entry* based on the contents of the lmages, indexing them and storing them on optical media.

Document Image Hardware requirements:

Real time image decompression and display place an important role on image processing hardware. Image decompression and display hardware supports 4 to 8 planes. 4 planes provide 16 colors and 8 planes provide 256 colors. The image planes are also called bit planes, because, they are addressed by a bit in a bytes. Images must be processed at the rate of tens to hundreds of pixels per nano-second. For high-resolution images, processing of the order of 10 pixels/ ns is enough for monochrome still images. Gray scale images consist of pixels that have shades of gray ranging from 16 to 256. Color images feature color hues instead of shades of gray. Most high-resolution monitors support 16 to 256 colors display capability. The number of colors that can be depicted depends on the number of bits used to define the palette.

2. Image processing and Image Recognition

Image processing involves image recognition, Image enhancement, image synthesis, and image reconstruction.

An image processing system may actually alter the contents of the image itself. Image processing systems employ the compression and decompression techniques, a wide range of algorithm for object recognition, comparing images of objects with pre-defined objects,

extrapolating finer details to view edges more clearly, gray-scale balancing and gray-scale and color adjustments.

Let us briefly review the various aspects of image processing and recognition.

Image enhancement**:** Most image display systems feature some level of image adjustment. Increasing the sensitivity and contrast makes the picture darker by making border line pixels black or increasing the gray-scale level of pixels.

Capabilities built in the compression boards might include the following

- **Image calibration**: The overall image density is calibrated, and the image pixels are adjusted to a predefined level.
- **Real time alignment**: The image is aligned in real-time for skewing caused by improper feeding of paper.
- **Gray-Scale normalization**: The overall gray level of an image or picture is evaluated to determine if it is skewed in one direction
- **RGB hue intensity adjustment**: Too much color makes picture garish and fuzzy. Automatic hue intensity adjustment brings the hue intensity within pre-defined ranges.
- **Color Separation**: A picture with very little color contrast can be dull and may not bring out the details. The hardware used can detect and adjust the range of color separation.
- **Frame averaging**: The intensity level of the frame is averaged to overcome the effects of very dark or very light areas by adjusting the middle tones.

Image Animation

Computers-created or scanned images can be displayed sequentially at controlled display speeds to provide image animation that simulates real processes.

The basic concept of displaying successive images at short intervals to give the perception of motion is being used successfully in designing moving parts such as automobile engines.

Image annotation

Image annotation can be performed in one of two ways: as a text file stored along with the image or as a small image stored with the original image. The annotation is overlaid over the original image for display purposes. It requires tracking multiple image components associated with a single page, decompressing all of them, and ensuring correct spatial alignment they are overlaid.

Optical Character Recognition

Data entry is the most expensive component of data processing, because it requires extensive clerical staff work to enter data.

Automating data entry, both typed and handwritten, is a significant application that can provide high returns. Optical Character Recognition (OCR) technology is used for data entry by scanning typed or printed words in a form.

Initially, people used dedicated OCR scanners. Now, OCR Technology is available in software. OCR technology, used as a means of data entry, may be used for capturing entire paragraphs of text. The capturing text is almost a\ways entered as a field in a database or in an editable document

Handwriting recognition

Research for Handwriting recognition was performed for *CADI* CAM systems for command recognition. Pen-based systems are designed to allow the user to write· commands on an electronic tablet. Handwriting recognition engines use complex algorithms designed to capture data in real time as it is being input or from an image displayed in a window, depending on the application. Two factors are important for handwriting recognition. They are the strokes or shapes being entered, and the velocity of input or the vectoring that is taking place. The strokes are parsed and processed by a shape recognizer that tries to determine the geometry and topology of the strokes. It attempts to compared it to existing shapes, such as predefined characters. The stroke is compare with the prototype character set until a match is found or all pre-defined prototypes have been checked without a match.

Multimedia system will use handwriting recognition as another means of user input.

Non-Textual Image Recognition

Image recognition is a major technology component in designing, medical and manufacturing fields. Let us review the basic concepts of image recognition architecture.

For example, a general Image recognition system,- the Image Understanding Architecture has the design which calls for three processing layers.

(i) 512 x 512 array of custom pixel processors that extract basic features such as lines and object boundaries. (ii) The features of an object extracted by the first layer are tracked by the DSP array, and that information is fed into 5l2-M byte RAM. (iii) At the highest level, sophisticated AI algorithms perform the difficult task of object and scene recognition.

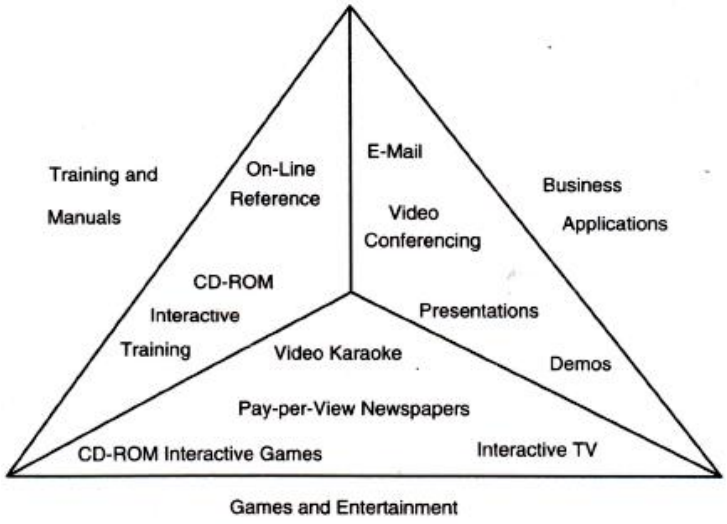
3. Full motion Digital video Applications

Full motion video has applications in the games industry and training, as well as the business world. Full motion video is the most complex and most demanding component of multimedia applications.

For business applications, some core requirements are needed.

(i) Full-motion video clips should be sharable but should have only one sharable copy.

(ii) It should be possible to attach full-motion video clips to other documents such as memos, chapter text, presentation, and so on.



The following features should be available:

(a) Features, of a VCR metaphor, such as, rewind, fast-forward, play, and search.
(b) Ability to move and resize the window displaying the video clip.
(c) Ability to view the same clip on a variety of display terminal types with varying resolution capabilities without the need for storing multiple copies in different form
(d) Ability to adjust the contrast and brightness of the video clip.
(e) Ability to adjust the volume of the associated sound.
(f) It should enable the users to place their own indexing marks to locate segments in video clip.

4. Electronic Messaging

The first generation mail system provided a basic text link between users and provided a valuble communications medium for users within a department or enterprise. These systems were the first alternative to paper based inter-office memos. The second generation of electronic mail system expands this capability tremendously by providing cross-platform and cross-network electronic mail with a bapability to attach other files ranging from

editable text files to bit mapped graphics and program executables.
A multimedia enabled electronic messaging system requires a sophisticated infrastructure consisting of the following to support it:

- Message storage and forward facility.
- Message transfer agents to route messages to their final destinations across various nodes in a multilevel network.
- Message repositories to store documents in a filing cabinents.
- Repositories for dense multimedia components such as images, videos, frames, audio messages, and full-motion video clips.
- Ability for multiple electronic hypermedia messages to share the same multimedia components residing in various repositories on the enterprise network.
- Local and global Directories to locate users and servers across an enterprise network.
- Automatic database synchronization of dynamic electronics messaging databases.
- Automatic protocol conversions and data formats conversions.
- Administrative tools to manage enterprise-wide networks.

A Universal Multimedia Application

It is an application that works on universal data type. This means that the application manipulates datatypes that can be combined in a document, displayed 'on a screen, or printed, with no special manipulations that the user needs to perform. A document of this type may be a phonebook,a color brochure with pictures and drawings, a memo,a phone message, a video phone message,or live teleconferencing. The application is truly distributed in nature. An important consideration for such a universal application is the methodology for dissemination of the information on a network.

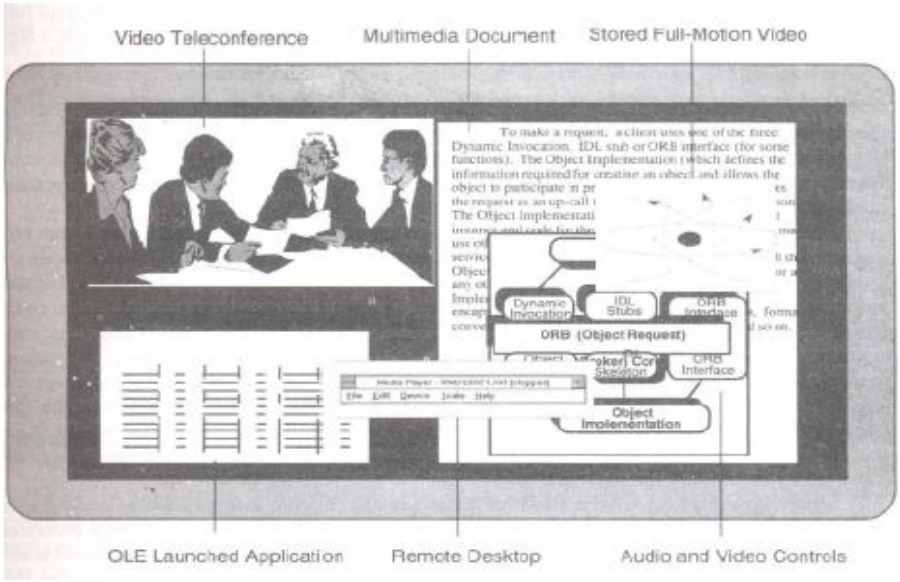


Figure describes the user screen for a universal multimedia application. In this screen, mix of windows for displaying still video and document images, a video conference window with a live session in progress, a remote live desk top, and a couple of other windows for applications such as electronic mail and desk top publishing.
To maintain all of these windows requires a substantial amount of CPU power. Digital Signal Processing assistance is needed to manage the multiple simultaneous decompressions for JPEG, MPEG and windows applications.

Full-Motion Video Messages

In addition to textual messages, electronic mail capability allows embedding of voice messages and video messages. Video messages may consist of video snapshots or live video with full-motion picture and sound.
Two technological concepts at play in the implementation of full motion video messages:

i) The storage and transmitted of a very large volume of data at a high rate,
(ii) Decompression of that data to present a continuous play back .
Viewer interactive Live video:

- The key difference between full motion video and viewer interactive video is that full motion video is a play back of stored video clips while viewer interactive video is a live. It may be possible to manage decompression and display of stored video clips more easily.
- Interactive Live video are the interesting applications used for direct interaction, medical application, manufacturing application and various process control application.
- Whereas full motion video are useful for messagings, information dissemination.

Audio and Video Indexing.

Indexing is an important and complex subject for multimedia design. Marking a position is called Indexing. Audio and video indexing are used in full-motion video in a manner similar to any video sequence, i.e.,. just as it would in a home movie, taped performance and so on.

The needs of the application must be a strong consideration for the type of indexing provideq with the system.

Key points for indexing of stored video clips:

* Indexing is useful only if the video is stored, indexing information is lost.

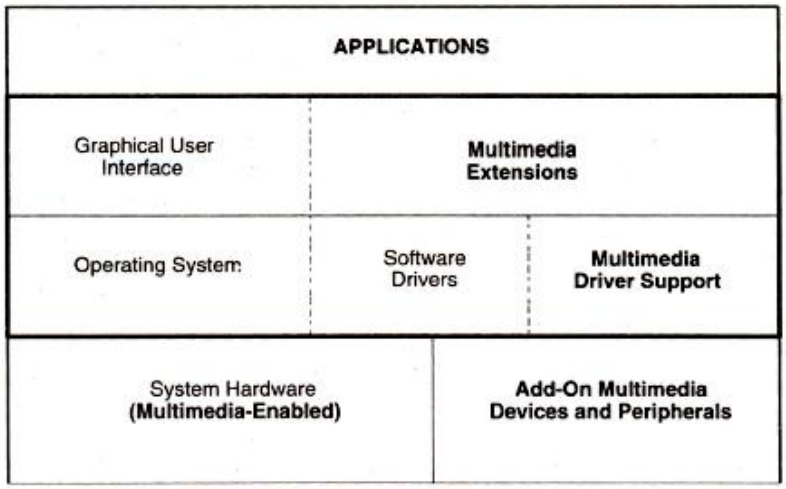
* When sound and video are decompressed and managed separately, synchronization is very important.

* Depending on the application, indexing information must be maintained separately for sound and video components of a video clip.

3.3 MULTIMEDIA SYSTEMS ARCHITECTURE

Multimedia encompasses a large variety of technologies and integration of multiple architectures interacting in real time. All of these multimedia capabilities must integrate with the standard user interfaces such as Microsoft Windows.

The following figure describes the architecture of a multimedia workstation environment. In this diagram.



The right side shows the new architectural entities required for supporting multimedia applications.

For each special devices such as scanners, video cameras, VCRs and sound equipment-, a software device driver is need to provide the interface from an application to the device. The GUI require control extensions to support applications such as full motion video

HIGH RESOLUTION GRAPHICS DISPLAY

The various graphics standards such as MCA, GGA and XGA have demonstrated the increasing demands for higher resolutions for GUIs.

Combined graphics and imaging applications require functionality at three levels. They are provided by three classes of single-monitor architecture.

(i) **VGA mixing: In** VGA mixing, the image acquisition memory serves as the display source memory, thereby fixing its position and size on screen:

(ii) **VGA mixing with scaling:** Use of scalar ICs allows sizing and positioning of images in pre-defined windows. Resizing the window causes the things to be

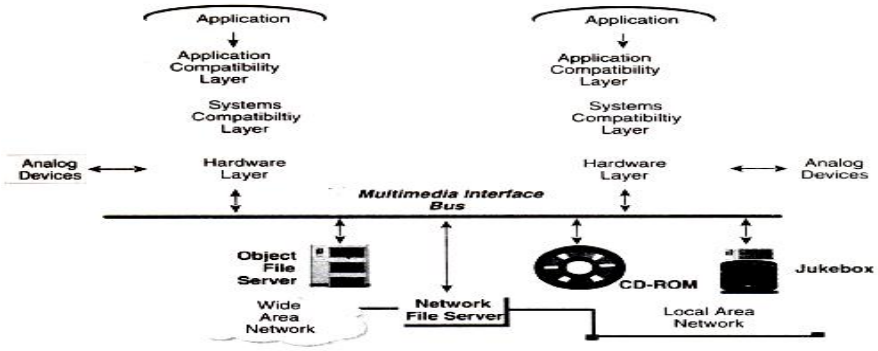
retrieved again.

(iii) Dual-buffered VGA/Mixing/Scaling: Double buffer schemes maintain the original images in a decompression buffer and the resized image in a display buffer.

THE IMA ARCHITECTURAL FRAMEWORK

The Interactive Multimedia Association has a task group to define the architectural framework for multimedia to provide interoperability. The task group has C0ncentrated on the desktops and the servers. Desktop focus is to define the interchange formats. This format allows multimedia objects to be displayed on any work station.

The architectural approach taken by IMA is based on defining interfaces to a multimedia interface bus. This bus would be the interface between systems and multimedia sources. It provides streaming I/O service"s, including filters and translators **Figure 3.4** describes the generalized architectural approach



NETWORK ARCHITECTURE FOR MULTIMEDIA SYSTEMS:

Multimedia systems need special networks. Because large volumes of images and video messages are being transmitted.

Asynchronous Transfer Mode technology (A TM) simplifies transfers across LANs and W ANs.

Task based Multi level networking

Higher classes of service require more expensive components in the' workstations as well as in the servers supporting the workstation applications.

Rather than impose this cost on all work stations, an alternate approach is to adjust the class of service to the specific requirement for the user. This approach is to adjust the class of services according to the type of data being handled at a time also.

We call this approach task-based multilevel networking.

High speed server to server Links

- **Duplication:** It is the process of duplicating an object that the user can manipulate. There is no requirement for the duplicated object to remain synchronized with the source (or master) object.
- **Replication:** Replication is defined as the process of maintaining two or more copies of the same object in a network that periodically re-synchronize to provide the user faster and more reliable access to the data Replication is a complex process.

NETWORKING STANDARDS:

The two well-known networking standards are

1. Ethernet 2. Token ring.

ATM and FDDI are the two technologies which are going to be discussed in detail.

ATM:

- ATM is a acronym for Asynchronous Transfer Mode. It's topology was originally designed for broadband applications in public networks.
- ATM is a method of multiplexing and relaying (cell-switching) 53 byte cells. (48 bytes of user information and 5 bits of header information).
- It has been increasingly used for transferring real time multimedia data in local network at a speed higher than 100Mbits/sec. ANSI has adopted ATM as the cell switching standard.
- **Cell Switching:** It is a form of fast packet switching. **Cells:** Short, fixed length packets are called cells.
- The ANSI standard for FDDI allows large-distance networking. It can be used as high-performance backbone networks to complement and extend current LANs.
- ATM provides high capacity, low-latency switching fabric for data. It is independent of protocol and distances. ATM effectively manages a mix of data types, including text data, voice, images and full motion video. ATM was proposed as a means of transmitting multimedia applications over asynchronous networks.

FDDI:

- FDDI is an acronym of Fiber Distributed Data Interface. This FDDI network is an excellent candidate to act as the hub in a network configuration, or as a backbone that interconnects different types of LANs.
- FDDI presents a potential for standardization for high speed networks.
- The ANSI (American National Standard Institute) standard for FDDI allows for single-mode fiber supporting up to 40 km between stations.
- It extends the current LAN speed from 100 Mbits/sec to several Gigabits per seconds, and large-distance networking.

Difference between ATM and FDDI

M	**DI II**
M pushes network speed as high as Mbits/sec	DI II pushes network speed as high as Mbits /sec
M is capable of lower speeds at the kstations.It reduces number of devices tocol translation require for munication between local and wide area work	DI II does not allow a user to connect to network at the spped required by the r, rather it requires the user to be capable upporting the network speed.

Benefits of Shared media Networks:

- Ease of installation
- Lack of common equipment
- Connectionless operation

Difficulties of Shared Media Networks:

- Wiring existing buildings
- Fault isolation

3.4 EVOLVING TECHNOLOGIES FOR MULTIMEDIA SYSTEMS

Multimedia applications use a number of technologies generated for both commercial business application as well as the video game industry.

Let us review some of these technologies in this section.

1. HYPERMEDIA DOCUMENTS

Hypermedia documents are documents which have text, embedded or linked multimedia objects such as image, audio, hologram, or full-motion video.The network speed and computing efficiency with which these hypermedia documents can manipulated has special implications for multimedia application such as messaging. Hypermedia has its roots in hypertext.

HYPERTEXT

Hypertext systems allow authors to link information together, create information paths through a large volume of related text in documents.

It also allows to annotate existing text, and append notes.

It allows fast and easy searching and reading of selected excerpts.

HYPERMEDIA

It is an extension of hypertext.

In that, we can include texts, any kind of information that can be stored in electronic storage, such as audio, animated video, graphics or full-motion video.

Hypermedia documents used for electronic mail and work flow applications provide a rich functionality for exchanging a variety of information types. The hypermedia document is a definition of a document and a set of pointers to help locate the various elements of the document on the network.

HYPER SPEECH

Multimedia stimulated the development of general-purpose speech interfaces. Speech synthesis and speech recognition are fundamental requirement for hyperspeech systems. Speech recognition is nothing but converting the analog speech into a computer action and into ASCII text. Speech-recognition systems cannot segment a stream of sounds without breaks into meaningful units. The user must speak in a stilted fashion. He should make sure to interpose silence between each word.

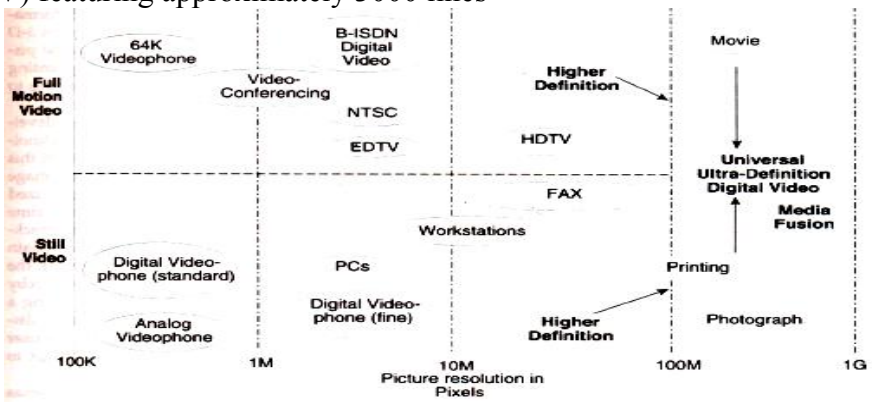
Speech synthesis and speech recognition requires substantial processing power. High performance microprocessors, such as main CPU in workstations,and Digital Signal Processingand codecs supporting encoding and decoding of sound based on emerging standards can handle speech recognition and speech synthesis.

2. HDTV AND UDTV

HDTV is an acronym of High-Definition Television.

The broadcasting standards such as NTSC, PAL, SECAM, NHK have an idea of bringing the world together on a single high-definition Television broadcasting standard.

The japanese broadcasting services developed a 1125-line, along MUSE system. A competing standard in the U.S. changed direction from analog to digital technology:A 1125-line digital HDTV has been developed and is being commercialized. NHK of Japan is trying to leapfrog the digital technology to develop ultra definition television (digital UDTV) featuring approximately 3000 lines



3. 3D TECHNOLOGIES AND HOLOGRAPHY

Three-dimensional technologies are concerned with two areas: pointing devices and displays. 3-D pointing devices are essential to manipulate object in a 3-D display system. 3-D displays are achieved using holography techniques.

The techniques developed for holography have been adapted for direct computer use.

The omniview three dimensional volumetric display device, developed by texas Instruments,Inc., uses lasers of different colors to project images on a moving surface sweeping a 3-D cylindrical display volume.

4. FUZZY LOGIC

Fuzzy logic is logic which is used for low-level process controllers.

Use of fuzzy logic in multimedia chips is the key to the emerging graphical interfaces of the future. It is expected to become an integral part of multimedia hardware. Fuzzy logic has mathematical principles. Hence, the application of multimedia can benefit those principles.

Like Digital Signal Processing(DSP) the Fuzzy Logic Signal Processing(FLSPs) provide interesting applications for multimedia systems. Fuzzy logic is a integral part of multimedia hardware and it is the key for emerging graphical interface.

The benefits of FLSPs are

5. DIGITAL SIGNAL PROCESSING

Digital Signal Processing are used in applications such as digital servos in hard disk drives, and fax/modems. DSP technology is used in Digital wireless communications, such as personal communication networks (pens), wireless local area networks and digital cordless phones.

DSP architectures and applications

A typical DSP operating system architecture would contain the following subsystems:

Memory Management: DSP architectures provide dynamic allocation of arrays from multiple segments, including RAM, SRAM and DRAM.

Hardware-Interrupt handling: A DSP operating system must be designed to minimize hardware-interrupt latency to ensure fast response to real time events for applications, such as servo systems. **Multitasking:** DSPs need real-time kernels that provide pre-emptive multitasking and user-defined and dynamic task prioritization

INTERTASK SYNCHRONIZATION AND COMMUNICATION

Mechanisms for intertask communication include message queues, semaphores, shared memory, and quick response event flags. Multiple timer services: The ability for the developer to set system clock interrupt managed timers to control and synchronize tasks is needed for most real-time applications.

Device-Independent I/O: DSP operating system should supports

(i) Asynchronous data stream
(ii) Synchronous message passing.

Use of DSP' s has evolved from traditional general purpose digital signal processors to application-specific and customizable DSPs. DSPs were conceived as math engines with a system architecture that was like that of a mini-computer with an array processor.

3.5 MULTIMEDIA DATABASES

Images, sounds and movies can be stored, retrieved and played by many databases. In future, multimedia databases will become a main source of interaction between users and multimedia elements.

1. MULTIMEDIA STORAGE AND RETRIEVAL

Multimedia storage is characterized by a number of considerations. They are:

(i) Massive storage volumes
(ii) Large object sizes
(iii) Multiple related objects
(iv) Temporal requirements for retrieval

- **Massive Data Volumes**

  A single multimedia document may be a combination of different media Hence indexing of documents, films and tapes is more complex. Locating massive data volumes requires searching through massive storage files.

  Locating and indexing systems can be understood only by a few key staff personnel. Hence it requires a major organizational eff0l1 to ensure that they are returned in proper sequence to their original storage location.

- **Storage technologies**

  There are two major mass storage technologies used currently for storage of multimedia documents.

  (i) Optical disk storage systems. (ii) High-speed magnetic storage.

  Advantages of Optical disk storage systems:

  (i) Managing a few optical disk platters in a juke box is much simpler than managing a large magnetic disk farm.

  (ii) Optical disk storage is excellent storage system for off line archival of old and infrequently referenced documents for significant periods of time

- **Multimedia object storage**

  Multimedia object storage in an optical medium serves its original purpose, only if it can be located fast and automatically. A key issue here is random keyed Access t6 various components of hypermedia database record. Optical media provides very dense storage. Speed of retrieval is another consideration.

  Retrieval speed is a direct result of the storage latency, size of the data relative to display resolution, transmission media and speed, and decompression efficiency. Indexing is important for fast retrieval of information. Indexing can be at multiple levels.

- **Multimedia document retrieval**

  The simplest form of identifying a multimedia document is by storage platter identification and its relative position on the platter (file number). These objects can then be grouped using a database in folders (replicating the concept of paper storage in file folders) or within complex objects representing hypermedia documents.

  The capability to access objects using identifiers stored in a database requires capability in the database to perform the required multimedia object directory functions. Another important application for sound and full motion video is the ability to clip parts of it and combine them with another set.

  Indexing of sound and full-motion video is the subject of intense debate and a number of approaches have been used.

2. DATABASE MANAGEMENT SYSTEMS FOR MULTIMEDIA SYSTEMS

Since most multimedia applications are based primarily on communications technologies, such as electronic mail, the database system must be fully distributed. A number of database storage choices are available.

The choices available are:

* Extending the existing relational database management systems, (RDBMSs) to support the various objects for multimedia as binary objects.
* Extending RDBMSs beyond basis binary objects to the concepts of inheritance and classes. RDBMSs supporting these . features provide extensions for object-programming front ends and/or C++ support.
* Converting to a full fledged object oriented database that supports the standard SQL language.
* Converting the database and the application to an object oriented database and using an object- oriented language, or an object-enabled SQL for development.

Multimedia applications combine numerical and textual data, graphics from GUI front-ends, CAD/CAM systems and GIS applications, still video, audio and full-motion video with recorded audio and annotated voice components. Relational databases, the dominant database paradigm, have lacked the ability to support multimedia databases. Key limitations of relational database systems for implementing multimedia applications stem from two areas: the relational data model and the relational computational model. RDBMSs have been designed to manage only tabular alphanumeric forms of data (along with some additional data types stored in binary form such as dates).

2.1 RDBMS EXTENSIONS FOR MULTIMEDIA

Binary Large Object (BLOB) is a data type which has been adapted by most of the leading relational databases. BLOBs are used for objects such as images or other binary data types.
The relational database is extended to access these BLOBs to present the user 'with a complete' data set. Extended relational databases provide a gradual migration path to a more object-oriented environment. Relational database tables include location information for the BLOBs which may be stored outside the database on separate image or video servers. Relational databases have the strength of rigorous set management for maintaining the integrity of the database

2.2 OBJECT-ORIENTED DATABASES FOR MULTIMEDIA

In object databases, data remains in RMS or flat files. Object databases can provide the fastest route to multimedia support. Object programming embodies the principles of reusable code and modularity. This will ease future maintenance of these databases.
Object database capabilities such as message passing, extensibility, and the support of hierarchical structures, are important for multimedia systems.
We can develop the application fastest class definitions. ODBMSs are extensible. They allow incremental changes to the database applications.

- **Extensibility:** Extensibility .means that the set of operations, structures and constraints that are available to operations are not fixed, and developers can define new operations, which can then be added as needed to their application.

Object-oriented software technology has three important concepts. They are:

- **Encapsulation: It** is the ability to deal with software entities as units that interact in pre-defined and controllable manner, and where the control routines are integral with entity.
- **Association**: It is the ability to define a software entity in terms of its differences from another entity.
- **Classification**: It is the ability to represent with a single software entity a number of data items that all have the same behaviour and the same state attributes.

Object orientation helps to organize the software in a more, modular and re-usable manner.

- **Encapsulation** allows for the development of open systems where one part of the application does not need to know the functioning of other part. It also provides autonomy; **Autonomy** means we can interface to a variety of external programs can be built in one class of objects and the storage of the data in another class of objects.

2.3 DATABASE ORGANIZATION FOR MULTIMEDIA APPLICATIONS

Data organization for multimedia systems has some key issues. They are:

(l) Data independence
(2) Common distributed database architecture
(3) Distributed database servers·
(4) Multimedia object management.

- **Data Independence**

  Flexible access by a number of databases requires that the data be independent from the application so that future applications can access the data without constraints related to a previous application.

  Key features of data independent designs are:

  1.Storage design in independent of specific applications.

  2.Explicit data definitions are independent of application program.

3.Users need not know data formats or physical storage structures.
4.Integrity assurance in independent of application programs.
5.Recovery in independent of application programs.

- **Distributed Data servers**
  Distributed database servers are a dedicated resource on a network accessible to a number of applications. The database server is built for growth and enhancement, and the network provides the opportunity for the growth of applications and distributed access to the data.
- **Multimedia Object Management**
  The object management system must be capable of indexing, grouping and storing multimedia objects in distributed hierarchical optional storage systems, and accessing these objects on or keyed basis.
  The design of the object management system should be capable indexing objects in such a manner that there is no need to maintain multiple storage copies.
  Multimedia transactions are very complex transactions. We define a multimedia transaction as the sequence of events that starts when a user makes a request to display, edit, or print a hyper media document. The transaction is complete when the user releases the hypermedia document and stores back the edited versions or discards the copy in memory (including virtual memory) or local storage .