Multimedia Database

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Abstract— A multimedia database is a controlled collection of multimedia data items such as text, images, graphic objects, video and audio. A multimedia database management system (DBMS) provides support for the creation, storage, access, querying and control of a multimedia database. The requirements of a multimedia DBMS are: multimedia data modeling; multimedia object storage; multimedia indexing, retrieval and browsing; and multimedia query support. This paper discusses a general framework for multimedia database systems and describes the requirements and architecture for these systems

Key Words: Multimedia Tools and Techniques, **Multimedia Data Type, Database Management Systems, Multimedia Database**

I. Introduction

Multimedia concerns the presentation of mixed modes of information (text, data, image, audio, and video) as digital signals, Some of the multimedia applications are;home applications (home, shopping and information sys-tem vs.) - video conferencing - education (distance learning, Just-in-time training) - digital libraries - virtual reality— telemedicine. Multimedia communication is concerned with the technology required to manipulate. transmit and control these audio-visual signals across a networked communications channel. .[4]

Multimedia systems need a delivery system to get the multimedia objects to the user. The first media used for distribution were magnetic and optical disks.Internet, as well as TCP/IP protocol suite or Net BIOS on isolated or campus LANs, became the next vehicles for distribution. Thc rich text and graphics capabilities of the W011d Wide Web browsets ale being augmcntcd with animations, video and sound[5]

The major technologies relevant to multimedia may be summarized as:

- compression technology
- video servers (server structure- disk organization and scheduling- video file systems)
- networks(internet- tokenring- ethernet- switched ethernet- ATM)
- data transmission techniques
- cable systems
- authoring systems
- Database systems.

A database is a collection of related data. A database management system (DBMS) is a general-purpose software system that facilitates the processes of defining; constructing and manipulating databases for various applications. Multimedia database contains different datatypes such as text, images, graphic Objects, animation sequences, video and audio. The different data types might require special methods for optimal storage. access,indexing and retrieval. A multimedia database management system provides a suitable environment for using and managing multimedia database.

Requirements for the multimedia DBMS

For the multimedia DBMS to serve its expected purpose, it must meet certain special requirements. Khoshafian and Baker1 described a multimedia DBMS architecture and the interaction of the different components needed to provide the services expected. The requirements are divided into the following broad categories:

- Traditional DBMS capabilities
- Huge capacity storage management
- Information retrieval capabilities
- Media integration, composition, and presentation
- Multimedia query support
- Multimedia interface and interactivity
- Performance.

Normally, individual objects in an image or video frame have some spatial relationship between each

other. These relationships produce some constraints when searching for objects in a database. Relational or object oriented data models have been proposed to cope with these constraints in the multimedia databases. An object oriented database management system is more suitable for developing multimedia applications.

CONTENTS OF MMDBA

- media data - actual data representing images, audio, video that are captured, digitized, processes,compressed and stored.
- media format data - contains format information of the media data after it goes through the acquisition, processing, and encoding phases.for instance, this consists of information such as the sampling rate, resolution, frame rate, encoding scheme etc.
- media keyword data - contains the keyword descriptions,for example, for a video, this might include the date, time, and place of recording , the person who recorded, the scene that is recorded,etc .this is also called as content descriptive data.
- media feature data - contains the features derived from the media data. for example, contain information about the distribution of colors, the kinds of textures and the different shapes present in an image. this is also referred to as content dependent data.[3]

II. Multimedia Data

Media is divided into two classes: continuous and discrete. Continuous media such as audio and video, change with time. Discrete media are time independent. Common examples of discrete media are text (formatted and unformatted), still images and graphics.[1]

2.1 Multimedia data types

To understand the requirements that multimedia database must satisfy, we need to know the types of multimedia data. Common multimedia data types found in a multimedia database are as follows and [5]

- Text
- Graphics: drawings and illustrations encoded using
  high-level descriptions like pic and postscript files.
- Images: pictures and photographs with encoding
- defined by standard formats such as JPEG and MPEG.[2]
- Animation
- Video
- Audio

Media	Raw	Registering	Descriptive
Text	Characters	Coding scheme (ASCII), length / end symbol	Key words, information for structuring
Images	Pixels	Height/ Width of picture, Mode of Compression, if JPEG, tables for quantization purpose	Pic.Date = 21/04/07 Pic.Reason = Birthday Etc
Video	Pixels	Frames/second, coding details, frame types...	Scene description
Audio	Sample sequence	Audio coding (PCM,...) , resolution of samples	Content of audio passages in short form

2.2 Multimedia data characteristics

Characteristics of multimedia data can be summarized here

- Lack of structure: Multimedia data tend to be un-structured. Therefore standard data management tasks.such as indexing arui content-based search and retrieval is not readily available.
- Temporality: Some multimedia data types such as
- video, audio animation sequences have temporal requirements that have implications on their storage.manipulation and presentation. In the same way, images, video and graphics data have spatial constraints in terms of their content.
- Massive Volume: Multimedia data swh as video andaudio Often require a large storage device.
- Logistics: Non-standard media can complicate processing. For example. a multimedia database application requires to use compression algorithms[5]

Purpose of a multimedia DBMS A multimedia database management system provides a suitable environment for using and managing multimedia database information. Therefore, it must support the various multimedia data types, in addition to providing facilities for traditional DBMS functions like database definition and creation, data retrieval, data access and organization, data independence, privacy, integration, integrity control, version control, and concurrency support. The functions of a multimedia DBMS basically resemble those of a traditional DMBS. However, the nature of multimedia information makes new demands—including determining what is needed and how to provide that functionality. Using the general functions provided by a traditional DBMS as a

guide, we can describe the purposes of a multimedia DBMS as follows:

- Integration. Ensures that data items need not be duplicated during different program invocations requiring the data.
- Data independence. Separation of the database and the management functions from the application programs.
- Concurrency control. Ensures multimedia database consistency through rules, which usually impose some form of execution order on concurrent transactions.
- Persistence. The ability of data objects to persist (survive) through different transactions and program invocations.
- Privacy. Restricts unauthorized access and modification of stored data.
- Integrity control. Ensures consistency of the database state from one transaction to another through constraints imposed on transactions.
- Recovery. Methods needed to ensure that results of transactions that fail do not affect the persistent data storage.
- Query support. Ensures that the query mechanisms are suited for multimedia data.
- Version control. Organization and management of different versions of persistent objects, which might be required by applications. [3]

In concurrency control, a transaction is a sequence of instructions executed either completely or not at all. In the latter case, the database is restored to its previous state. Defining the appropriate granularity for concurrency is a problem in multimedia databases. Traditional databases use a single record or table as the unit of concurrency; multimedia databases typically use a single object (or composite object) as the logical unit of access. Thus the single multimedia object could form the unit of concurrency. In achieving persistence, a simple method is to store the multimedia files in some operating system files. However, the huge data volumes make this approach costly to implement. Moreover, the system also needs to store the multimedia metadata and possibly composite multimedia objects.

III. Multimedia Database Management System

The development of multimedia computing systems can benefit from traditional DBMS services such as:

- Data independence (data abstraction)
- High level access through query languages
- Application neutrality (openness)
- Controlled multi-user access (concurrency control)
- Fault tolerance (transactions. recovery)
- Restriction unauthorised access and modification of stored data (privacy).

Also, multimedia objects have temporal and spatial relationships that must be taken into account for synchronization and display of information. These relationships should be modeled explicitly as part of the stored data.Thus. even if the multimedia data is stored in files, their relationships need to be stored as part Of the metadata in some DBMS

3.2 Query in multimedia database

The query is one of the most important parts of DBMS. Multimedia query languages must deal with complex spatial and temporal relationships inherited in the wide range of multimedia data types. Powerful query languages could help manipulate multimedia DBMS and maintain the desired independence between the database and the application.[5]

Multimedia data queries can be subdivided into following types:

- keyword querying
- semantic querying
- visual query
- video query

Keyword querying only uses well-defined queries.Semantic and visual querying designed to use the fuzzy query method. Visual query language is useful,because it can formalize complicated queries. Future multimedia retrieval systems will have to support access to information at different semantic levels to reflect diverse application needs and user queries.

Video query as digital video databases become more and more spread, finding video in large databases becomes a major problem. Because of the nature of video,accessing the content of such databases isinherently a time-consuming operation.

The indexes such as bibliographic, structure and content data are identified in order to satisfy the queries Bibliographic data category includes information about the entire video and traditional metadata. A video query is more complicated than a traditional query of text databases. In addition to text, a video clip has visual and audio information as well as the dynamics associated with the presentation of such information.

3.2.1. Content -based indexing and retrieval.

Users of video-retrieval systems want to find videos on the basisof the semantic content of the video. Content-based image retrieval systems typically let users desired images from a collection on the basis of primitive features representing color, texture or shape . A retrieval system should embeded a semantic level reflecting as much as possible the one human refers to during interrogation. The most common way to enrich a visual information retrieval system semantics is to annotate pictorial information manually at storage time through a set of external keywords describing the pictorial content
Content-based search of an image database is well suited for searching scientific databases such as satellite-image, medical and seismic-data repositories. In these systems, the volume and diversity Of information do not allow the a priori generation of exhaustive indexes.[5]

Application of Multimedia Database Management System

- **Documents and record management :** Industries and businesses that keep detailed records and variety of documents. Example: Insurance claim record.
- **Knowledge dissemination :** Multimedia database is a very effective tool for knowledge dissemination in terms of providing several resources. Example: Electronic books.
- **Education and training :** Computer-aided learning materials can be designed using multimedia sources which are nowadays very popular sources of learning. Example: Digital libraries.Marketing, advertising, retailing, entertainment and travel. Example: a virtual tour of cities.
- **Real-time control and monitoring :** Coupled with active database technology, multimedia presentation of information can be very effective means for monitoring and controlling complex tasks Example: Manufacturing operation control.[2]

Challenges of Multimedia Database

There are many challenges to implement a multimedia database. Some of these are:

- Multimedia databases contains data in a large type of formats such as .txt(text), .jpg(images), .swf(videos), .mp3(audio) etc. It is difficult to convert one type of data format to another.
- The multimedia database requires a large size as the multimedia data is quite large and needs to be stored successfully in the database.
- It takes a lot of time to process multimedia data so multimedia database is slow.[3]

IV. Conclusion

Multimedia Databases are capable of handling vast amount of multimedia items which a common database cannot. MMDB helps in various aspects like creating virtual museum, developing multimedia application, creating excellent teaching packages and in multi user operations too. This review concludes that database has admirable impacts like learning such as in classroom teaching and learning, keeping records of multiple data types, flexible system for Geographical Information Systems, combination and storing of olfactory information, full-fledged images, animations, videos, providing 3Ds, TV newscast & Newspapers, making efficient browsing by the combination of intelligent agents and MMDB and providing a great way for technology to enhance the working of applications in a variety of ways. Multimedia database is a backbone support and work effectively for large amount of good quality multimedia data. Multimedia database is a great and useful invention and facility and it is developing day by day. The day by day developments will prove the broad positive impacts of MMDB.

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