Building MPEG-7 Image/Video Digital Libraries

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1. Background

Creation of image/video libraries poses many interesting and challenging problems. The traditional text-based approach to manipulate multimedia data faces two major problems, the laborious manual annotation process and the subjectivity to the human perception due to the rich content of multimedia data. Perceptual subjectivity and imprecise annotation process may cause irrecoverable mismatches between multimedia data search and retrieval. To overcome these problems, content-based retrieval scheme was proposed in the early 90's. Instead of using manual, textual annotations, the scheme uses automatic feature extraction techniques based on color, texture, shape etc. Despite a variety of researches and developments, this approach faces technical complexity and performance problems.

The recent MPEG-7 activity attempts to standardize multimedia data description schemes to solve the problems. The MPEG-7 approach will provide efficient indexing and searching schemes by converting complex multimedia content search problem into multimedia description search, which will in turn make database management much more efficient. The proposed research and development will be useful for many digital library applications, such as movie, broadcast, environment, medical, distance learning applications, etc.

2. Research and Development Issues

2.1   MPEG-7 Video Digital Library

We focus on research and development of video digital library system based on MPEG-7 standards. We classify the MPEG-7 Video Digital Library system components in four functional modules, Description Schema Designer (or Editor), Description Generator, Presentation Module, and Multimedia Server as depicted in Figure 1.

When editing raw video data, the Description Schema Designer generates MPEG-7 descriptors and their indices. During the process, the Description Generator generates MPEG-7 descriptions. Encoded video data and description data will be stored in the database separately. When the user wants to view video clips out of the MPEG-7 Video Digital Library, the query passes through the Presentation Module and the Result is displayed as the result. We briefly describe the operations of the modules below.

● **Description Schema Designer (or Editor):** We use XML as the schema description language in defining a schema of a video library application based on MPEG-7. The Description Schema Designer output will be used when the Description Generator generates annotations for retrieval.

● **Description Generator:** This module consists of Description Editor and Encoder, The former will generate MPEG-7 descriptions and the latter will generate the coded MPEG-7 descriptions.

● **Multimedia Server:** This server contains index information and video data. The server provides stable services through a user interface for video data. For this purpose, the server provides transaction management and information retrieval facility.

● **Presentation Module:** This module allows the user to view the video library data. It has sub-modules, such as MPEG-7 player and local retrieval module, which interacts with the Multimedia Server for information retrieval.
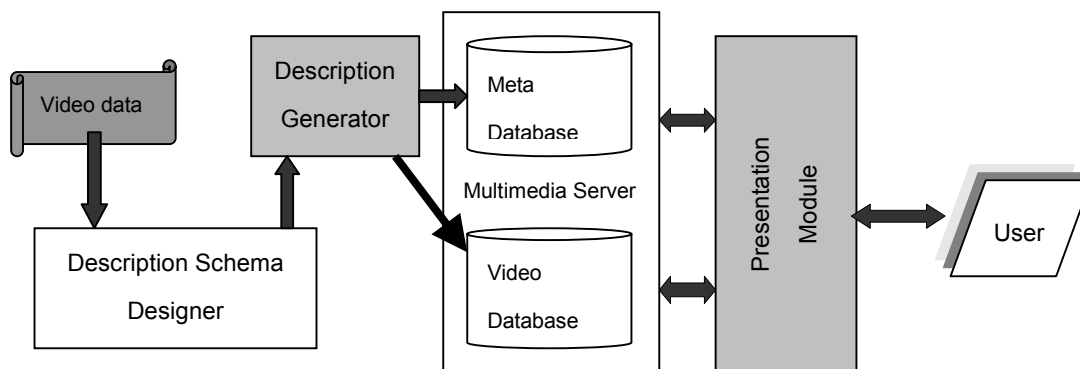

Figure 1. Architecture of the MPEG-7 Video Digital Library

2.1 Development of a Meta-Search Engine for Building MPEG-7 Described Image Libraries from the Legacy Resources

The Meta-Search Engine will give the internet users a powerful facility to search image data over the internet using MPEG-7 description. The image data extracted from the web are re-built into the image libraries with MPEG-7 description. With this Meta-Search Engine, as an image library server, a user is able to build up MPEG-7 based specialized image database of his or her own, such as portrait fine art museum, celebrity picture gallery, sports interested gallery, etc. by taking advantage of all useful facilities of MPEG-7 descriptions. Given a user query, the server will translate it into formats proper to different conventional web search engines, such as Altavista, Yahoo, Lycos, etc., for the search of requested image data from the existing legacy resources in the web. The query will also be transformed into MPEG-7 query format for the search of image data out of the MPEG-7 image library. The image data that are not available in the MPEG-7 library will be searched from the legacy resources and presented to the user. At the same time the images are added to the MPEG-7 image library. The intended operation will give facilities of: (1) building MPEG-7 image libraries with legacy image data extracted by conventional search engines, and (2) fast retrieval services for the

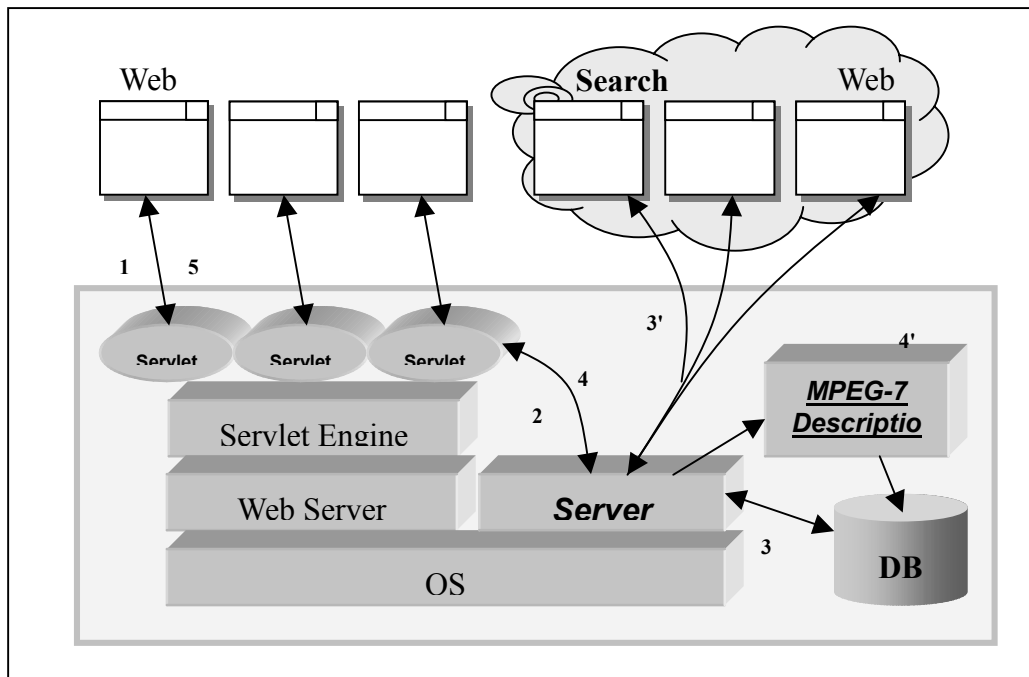internet users. Figure 2 illustrates the service architecture.

Figure 2. Architecture of Meta-Search Engine

Biographical Sketch

Soon J. Hyun received the Master degree in electrical engineering from the Katholike Universitate Leuven, at Havelee, Belgium; and the Ph.D. degree in electrical and computer engineering from the University of Florida, in 1987, and 1995, respectively. His Ph.D. dissertation was on parallel query processing in object-oriented temporal database systems. He is presently an assistant professor of the School of Information and Computer Engineering (SICE), Information and Communications University (ICU), Taejon, Korea. From 1983 to 1997, he worked with the Electronics and Telecommunications Research Institute (ETRI), Taejon, Korea, where he was leading a digital library development project in and effort to build the Korea National Information Infrastructure. From 1984 to 1986, he was a research staff at Bell Telephone/ITT (presently, Bell/Alcatel), Antwerp, Belgium, where he worked on the development of telecommunications network protocol systems. His recent research interests include object-relational databases, multimedia databases, active database supporting systems, digital library and electronic commerce.