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Context-Aware Querying in Multimedia Databases – A Futuristic Approach

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***Abstract*—** Efficient retrieval of multimedia objects has gained enormous focus in recent years. A number of techniques have been suggested for retrieval of textual information; however, relatively little has been suggested for efficient retrieval of multimedia objects. In this paper we have proposed a generic architecture for context-aware retrieval of multimedia objects. The proposed framework combines the well-known approaches of text-based retrieval and context-aware retrieval to formulate architecture for accurate retrieval of multimedia data.

***Keywords*—** Context-aware retrieval, Information retrieval, Multimedia databases, Multimedia data.

I. Introduction

REQUIREMENTS of high processing power and large storage space for multimedia data have been resolved by the use of computational grids and data grids. Despite the large availability of the required resources, efficient and accurate retrieval of information is still a major concern. The problem of information retrieval is amplified when query involves retrieval of multiple types. This issue in retrieval of multimedia information is due to a large semantic gap between the actual multimedia data and human perception about it [8].

People have always used the context of the situation to get things done. We use our understanding of current conditions to structure activities, to navigate the world around us, to organize information, and to adapt to unusual circumstances.

Context-awareness has also been an integral part of computing. Even simple forms of context, such as time and identity, have been used in a number of meaningful ways. For example, by being aware of the current time, computers can give us reminders of calendar events. By being aware of our identity through logins, computers can personalize the look and feel of our user interface. Different kinds of context can also be used together. For example, computers can tag files with both time and identity, giving us several ways of organizing and finding information created in the past [9].

In this paper, we propose a generic architecture for efficient context-aware retrieval of multimedia data. Our proposed approach merges the well-known concepts of multimedia databases, text-based information retrieval, and context-aware systems for efficient and accurate retrieval of multimedia data.

The rest of the paper is organized as follows: Section 2 discusses related work in the field, Section 3 provides details of our proposed architecture, whereas, Section 4 concludes the paper.

II. Related Work

Lot of research has been done for context information retrieval of textual data, but comparatively little work has been done for context-based retrieval of multimedia data. An architecture for context prediction has been proposed by Rene Mayrhofer [1], which performs unsupervised context prediction. This architecture also attempts to predict future context. Another context aware multimedia computing in the intelligent hospital is proposed by Scott Mitchell et al [2]. This framework is built on QoS DREAM middleware platform. A generic model for context aware for ambient intelligence was proposed by Asuman et al [3]. This architecture combines Context Information, Domain Specific Agents, and Ontology. Ontology information is stored in ebXML registry. P.J. Brown and G.J.F. Jones have provided context-aware retrieval for text-based systems [4]. A case-based user profiling mechanism was proposed by Pawel et. at [5]. This type of profiling was combined with FIPA complaint agents and a PTA architecture was proposed. In order to enhance the user queries, concept hierarchies were proposed by the Ahu et al. [6]. Jason has proposed an infra structure for context aware computing 'The Context Fabric'. This infrastructure used context data store for modeling for storage and retrieval of context data [7].

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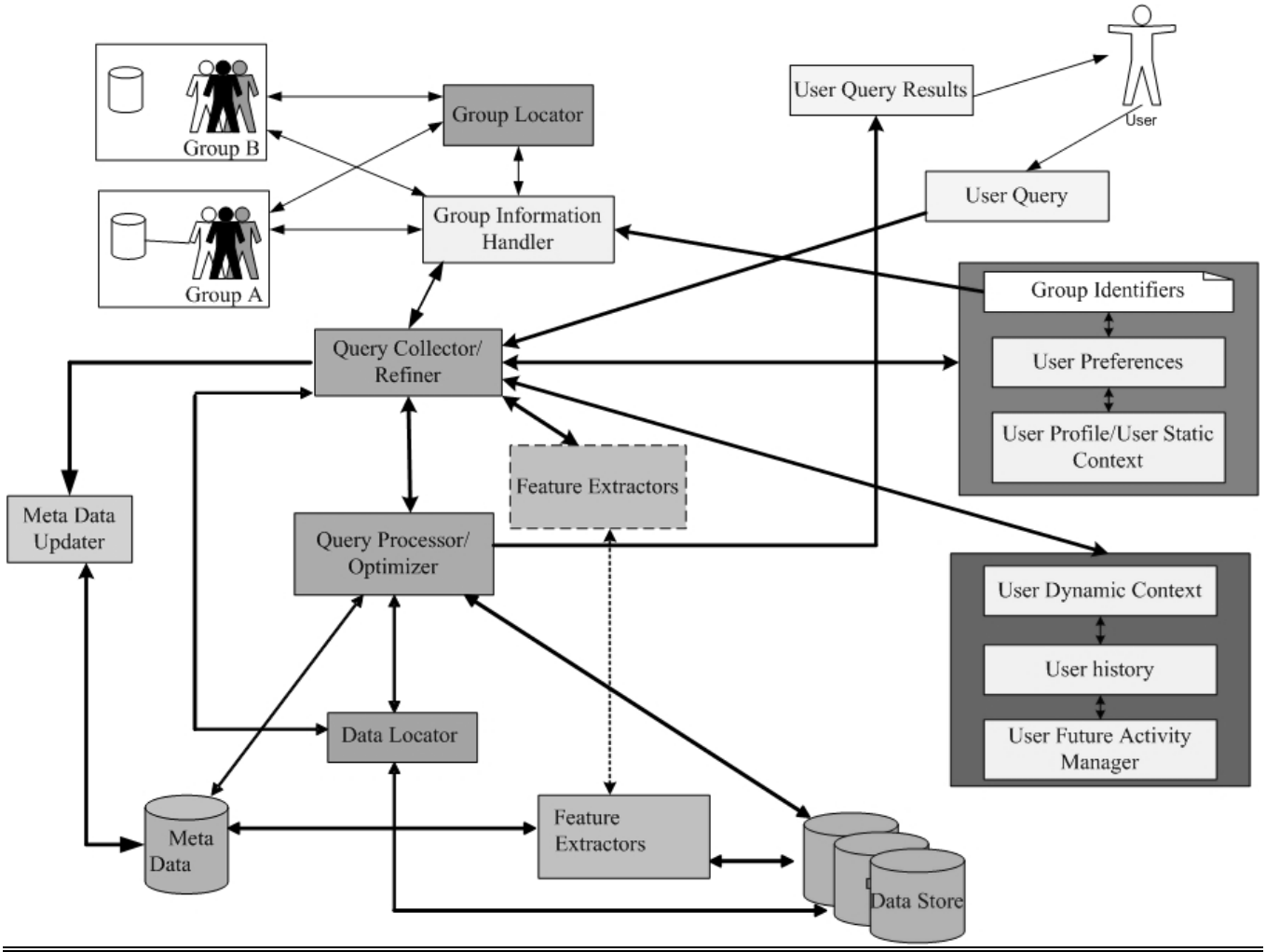


Figure 1: Proposed Architecture

III. Proposed Framework

Future Multimedia information retrieval models should not only rely on posing queries based on underlying fixed schema, but also consider the user's context (static context as well as dynamic context), the user's history, the user's future activities, and the user's group profile. In our proposed architecture, we have augmented the standard multimedia information retrieval techniques with these context-aware information retrieval strategies. The main components of our proposed architecture are shown in Fig. 1, and are described below.

A. User query component

This component depicts the interface on which the user poses his desired query. The query can be either keyword based or image based.

B. Query Collector/Refiner

This component is the most important component of the architecture. It is responsible to refine the query by the user by using multiple components in the architecture. The query is refined based on the user preferences, user profile, user current context (static and dynamic), and user future context. The refined query is posted to group information handler to obtain results of already conducted searches by any of the related groups.

C. Query processor/optimizer

This component takes the query refined by the Query Collector/Refiner for processing and optimization purposes.

The query is then posed to the Meta-data component; if the results are found up to a particular threshold then actual multimedia objects are extracted from the Data Store through the Data Locator and are presented to user through the User Query Results component.

D. Meta-Data

This component contains meta-data about the data sources. A note has to be made that meta-data is not exclusively stored in this component, since part of the data sources store meta-data themselves (like, for example, xml documents). The meta-data would consist of two portions. The first portion would be generated by the feature extractors and can be stored

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in the meta-data component or can be stores as a part of the data sources (like, for example, xml documents). The second portion of the meta-data would be populated based on the response/feedback of the user's query.

E. Meta-Data Updater

This component is responsible for updating the portion of meta-data that is populated based on the successful query or positive feedback by the users.

F. Data locator

This component has information about the location and functionality of all components and data sources.

G. Data sources

In the data sources, the data is stored. This can be done in several formats. Examples are text, xml, html, video/audio, or relational, or object oriented databases.

H. Feature Extractors

These components can extract certain features from the multimedia data. Examples are colour histograms and shape detection feature extractors.

I. Group Locator

This component locates the information about the location of groups based on the group identifiers.

J. Group Information Handler

This component is responsible for collecting query related information from the available group information.

K. Group Identifier(s)

Group locator uses these identifiers to identify the group(s) a user might be associated to. Group identifier(s) are alloted to users based on their static profile, first time the user uses the system.

L. User (Query) Preferences

User can provide certain query specific preferences in a standard xml format, which would be used by the Query Refiner/Query Optimizer component during the query refinement process

M. User Profile/Static Context

User Profile and Static Context is composed of a number of information items like the User Identity, which could probably be the user's email address or the system assigned id. User profile contains the information regarding job description/type, expertise, hobbies, and interests of the user. It also includes social situation of the user: marital status, and information about any nearby people who already use the system. The profile and static context information would be used, as discussed by Ahu Sieg et al. [6] for query elaboration purpose.

N. User Dynamic Context/History/Future Manager

The module deals with future/history and dynamic context for retrieval. The module has the following sub-systems:

Calendar Diary System

This system contains information about the important meetings, lectures, workshops, etc . Date and time of each event is also stored. This module provides the information to the Future Context Diary.

Reminder System

This system contains information about the important reminders of a person. Functionality of this module is similar to the previous module.

Future Context Diary

This module stores information retrieves information from Calendar/Diary System, Reminder System, and To Do List. This output of this module is combinaed with other modules like History Module, User Profile module. Future Context Diary has three levels of information

-- Near Future Information: This is the information that is related to the near future. This information has more effect on the query as compared to the lower two levels of information. When near future has passed, the Future to History Converter modules converts this information to User History module.

-- Mid Future Information: This level of information is little far in future as compared to Near Future Information. The information from this level flows to Near Future Module.

-- Far Future Information: This is the far information in the future and has less impact on the query as compared to above two levels. The information from this module flows to Mid Future Level.

Future to History Converter

This module converts the information of future, when it has passed in to the User History module.

Current Context Predictor

This module takes information from Future Context Diary and User History to store the information in the Current Conext Diary.

Current Context Diary

This modules contains information about the current

context of the user. Query module takes information from this module while providing result.

O. User Query Results

This module collects the refined results from the Query Processor/Optimizer component, and presents the results to the user.

IV. Conclusion and Future Work

In this paper we have proposed a generic context-aware architecture for multimedia information retrieval on multimedia databses. We have discussed individual components of the architecture; however, technical details have been left out due to severe space limitations. We are currently developing a case study for the proof of concept of our proposed approach. Our future work includes building a prototype to compare the performance of our proposed architecture with existing frameworks.

References

[1] R. Mayrhofer , "An Architecture for Context Prediction", Institut fur Pervasive Johannes Kepler Universitat Linz, Altenbergerstr. 69, 4040 Linz, Austria.
[2] S. Mitchell, M. D. Spiteri, J. Bates and G. Coulouris. "Context-Aware Multimedia Computing in the Intelligent Hospital", In Proc. SIGOPS EW2000, the Ninth ACM SIGOPS European Workshop, Kolding, Denmark, September 2000.
[3] A. Dogac, G. B. Laleci, Y. Kabak , "A Context Framework for Ambient Intelligence", Software Research and Development Center, Middle East Techincal University, Inonu Bulvari, METU campus, Ankara, Turkey.
[4] P.J. Brown , G.J.F. Jones, "Context-aware Retrieval: Exploring a New Environment for Information Retrieval and Information Filtering", Springer Verlag London Ltd, Personal and Ubiquitous Computing 2001.
[5] P. Waszkiewiez, P. Cunningham, C. Byrne, "Case-based User Profiling in a Personal Travel Assistant", In Autonomous Agents 98, Minneapolis MN USA.
[6] A. Sieg, B. Mobasher, S. Lytinen, R. Verke, "Using Concept Hierarchies to Enhance User Queries in Web-based Information Retrieval", School of Computer Science, Telecommunication and Information Systems, DePaul University.
[7] J. I. Hong, "The Context Fabric: An Infrastructure for Context-aware Computing", Group for User Interface Research, Computer Science Division, University of California, Berkley, USA.
[8] L. Dunckley, "Multimedia Databases: An object-relational approach", Addison-Wesley Professional, 2003
[9] Jason Hong, James A. Landay , "An Infrastructure Approach to Context-Aware Computing", Human-Computer Interaction, 16(2&3), 2001

Open Science Index, Computer and Information Engineering Vol:1, No:5, 2007 publications.waset.org/12980/pdf