Kong, S.C., Ogata, H., Arnseth, H.C., Chan, C.K.K., Hirashima, T., Klett, F., Lee, J.H.M., Liu, C.C., Looi, C.K., Milrad, M., Mitrovic, A., Nakabayashi, K., Wong, S.L., Yang, S.J.H. (eds.) (2009). *Proceedings of the 17th International Conference on Computers in Education [CDROM]*. Hong Kong: Asia-Pacific Society for Computers in Education.

The Development and Evaluation of the Metadata Attaching System with LOM Database

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Abstract: NICER—the National Information Center for Educational Resources in Japan—is a central website providing all kinds of information about educational resources in Japan. NICER currently has 280,000 resources. The aim of this study is to develop and evaluate a Web system that attaches metadata to educational resources, especially images, in the database. This system deals with LOM (Learning Object Metadata). The user can attach metadata by searching for the images on the Web, along with the same metadata of similar images by using a similarity engine. This system also has three modes: package-images mode, one-image mode, and modification mode. This system has been evaluated and inspected by subjects, and is being put to practical use at NICER in Japan. A large number of digital images are stored on the Internet. From an educational perspective, it is very helpful that a vast number of images on a number of topics are readily available and are in some cases free.

Keywords: LOM, Educational Resources, Images Database, NICER

1. Introduction

NICER [1], the National Information Center for Educational Resources, is a central website providing all kinds of information on educational resources in Japan. NICER currently has 280,000 resources. NICER's mission is to support teachers and students in various ways and to provide them with the information they want and need. Information content includes LOM (Learning Object Metadata) so that users can directly access their desired information page. It is difficult to attach LOM to many resources. Since NICER is used for educational purposes, the LOM of NICER needs strict consistency, which requires a great deal of time, money, and people. NICER has ten staff members; word control is strictly upheld and practiced. If metadata or the keywords in LOM are not controlled well, users cannot retrieve the most suitable content.

2. The Purpose of this Research

The purpose of this research is to find out how to provide metadata to each image or motion picture. Until now, a content (database) supplier attaches metadata by itself directly with an Excel or CSV file. At NICER (in the old days) or in other systems [3], a material and its metadata are separated at the time of registration in the system. Metadata are entered in Excel format, which requires a great deal of time and effort. Thus, there are some system approaches, along with narrow domain and heuristic (some knowledge in advance given by user) approaches. Christopher proposed [4] that the objects in images are inferred from segmentation and infection. Google Image is to use caption or text close

to the image. But both systems are many noises in metadata and can be less precise retrieval. The LOM of NICER needs strict consistency because NICER is for educational use. The aim of this study is the development and evaluation of metadata attaching Web system with saving some trouble and keeping consistency.

3. System Architecture

In this section and later, "the user" means NICER staff who work toward LOM management and operation. This system deals with LOM. The user of this kind of system is generally employed in a database provider.

3.1 System Architecture

This section explains the system in detail. On the client side, this system shows a webpage made dynamically with PHP3. On the server side, the operating system is Red Hat Linux 6.2, the system is written with C, the web-server is Apache, and the database system is PostgreSQL6.5, so all parts of this system consist of free software. The server part consists of a user authorization part, an image storage part, a metadata search engine, a feature search engine, and an input-output part (Figure 1). Images or motion pictures are stored in the image database, which deals with JPEG or MPEG-1/2. The metadata with images or motion pictures are in the metadata database, which deals with LOM. The features of images or motion pictures are in the feature database. The system authorizes the user by user-ID and password. Next, the user chooses one of three modes: package-image mode, one-image mode, and modification mode.

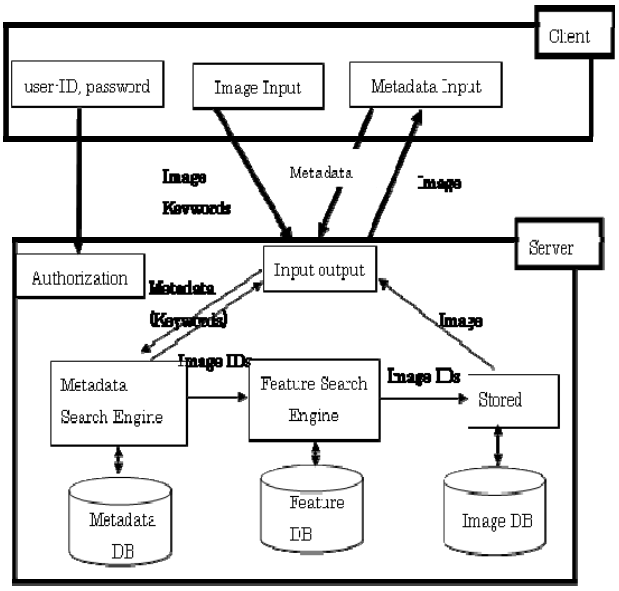

Figure 1: System Architecture

The user interface is shown in Figure 2. On the left side, an image is shown. On the right side is the metadata input space, according to LOM. The user inputs metadata in each textbox or clicks the checkboxes. On the bottom, similar images are shown.

Figure 2: User Interface

3.2 System Modes

This system has three modes: package-image mode, one-image mode, and modification mode.

1) In package-image mode, on the client side, the user first chooses image files through the Web. On the server side,

the input-output part receives them and inputs the features of one of them into the feature search engine. Second, this engine searches features for an image-ID in the feature database, and lets the result, which is an image-ID, pass into the metadata search engine. Third, this engine searches metadata for the image-ID in the metadata database, and lets the result pass into the image stored part. Fourth, this part searches for the image itself by its image-ID. Finally, the input-output part sends this image to the client and shows it to them using PHP3. The user then inputs and copies the metadata shown on the Web (Figure 2). These steps are repeated for a number of images.

2) In one-image mode, on the client side, the user first chooses one image file through the Web. The later procedures are the same as package-image mode.

3) In modification mode, on the client side, the user first inputs keywords through the Web. On the server side, the input-output part receives them and passes them into the metadata search engine. Second, this engine searches for an image-ID with metadata in the metadata database, and lets the results, which are a set of image-IDs, pass into the feature search engine. Third, this engine searches for the image-ID with the set in the feature database, and lets the result pass into the image stored part. Fourth, this part searches for the image itself by its image-ID. Finally, the input-output part sends this image to the client and shows it to them using PHP3. The user then inputs or copies the metadata shown on the Web.

4. Conclusion

This system is now constructed by NICER and our staff members often use it. This paper shows how to develop and evaluate a system for attaching LOM to images in a database. The user can attach LOM by looking at the images on Web, using the same metadata of similar images with a similarity engine. This system also has three modes: package-image mode, one-image mode, and modification mode. The system was evaluated and inspected by subjects who confirmed its effectiveness; we thereby proved that it is useful for the strict consistency of LOM. This system will be used for the consistency of NICER LOM that are already attached.

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References

[1] National Information Center for Educational Resources, http://www.nicer.go.jp/
[2] Bateman, Scott, Christopher Brooks & Gord McCalla, “Collaborative Tagging Approaches for Ontological Metadata in Adaptive E-Learning Systems,” *Proc. of 4th International Conference on Adaptive Hypermedia and Adaptive Web-based Systems*, 3-12, 2006.
[3] Shinohara, Masanori, Kana Tokuhata, Mayumi Okamoto, Fumio Miyake & Kazuo Nagano, “Development of the Search Engine for School Educational Resources and Student's Retrieval Process,” Trans. *Japanese Society for Information and Systems in Education, 18*(2), 200-209.
[4] Town, Christopher & Sinclair, David, “Content Based Image Retrieval using Semantic Visual Categories,” *Technical Report TR2000-14 AT&T Laboratories,* 2000.
[5] Fukumoto, Toru & Kanji Akahori, “The Criteria and Evaluation of Metadata/Keywords in Image Retrieval, “*Proc. of the ICCE/ICCAI 2000*, 542-546.
[6] Fukumoto, Toru & Kanji Akahori, “An Analysis of Image Cognition Structure for Metadata Type Image Retrieval,” *Proc. of the ICCE/SchoolNet 2001,* 367-371.