B-023

A Proposal on Flexible Information Management System for Next Generation of Museum

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1. Research Background

Many recent researches[1-3] on museum systems have focused on using metadata and recommendation systems to implement intelligent museum systems. Nevertheless, the fundamental problems such as ambiguous ontology and difficulty of creating information (metadata) based on international standards have not been thoroughly studied and solved yet.

As we already known, information and ontology for artifacts in museums are created by curators. However, same object can have different information, ontology or schema. Because it depends on the knowledge and viewpoint of each curator or visitor. As a result, this is a crucial problem for making high performance recommendation systems in museums. Furthermore, in order to create metadata based on international standards for an artifacts or objects is not easy tasks. Most of museum metadata standards are in XML format and complicated such as Dublin-Core[4] and CIDOC-CRM[5], but many curators are non-IT users. In other words, to create and manage metadata are difficult tasks for many museum curators. Consequently, the volume of metadata has not been increased effectively. Moreover, information sharing among museums is difficult to be implemented, because each is using different metadata standards.

Hence, a new novel method and architecture for cultural information management in museums to solve above mentioned problems, and also effectively support future applications (recommendation and navigation system) are necessary to be studied and realized.

2. Flexible Information Management System

An illustration of the proposed system architecture in this research is shown in Figure1. In our proposed architecture, museum visitors can receive not only one information representation of each artifact (like traditional museums) but also various kinds of information representation. In other words, each artifact can have many types of information representation based on user profiles or their preferences. In addition, the quantity of information will be increased because curators and anyone can provide information without concerning of any metadata standards. A cloud computing environment is also installed and tested for processing huge volume of information received from many sources. According to the proposed architecture, information sharing among museums can be realized. The total outcome of this research will increase and maximize the attractiveness of museums, and as a result it can motivate people to come to museum more frequently.

As be seen in Figure 1, one of the main components of this architecture is flexible information management system, and we have proposed a system to solve such above mentioned issues.

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In the proposed system shown in Figure 2, all artifacts in the museum (object in the real-world) are equipped with RFID, and each artifact has unique ID. Curators or anyone can create

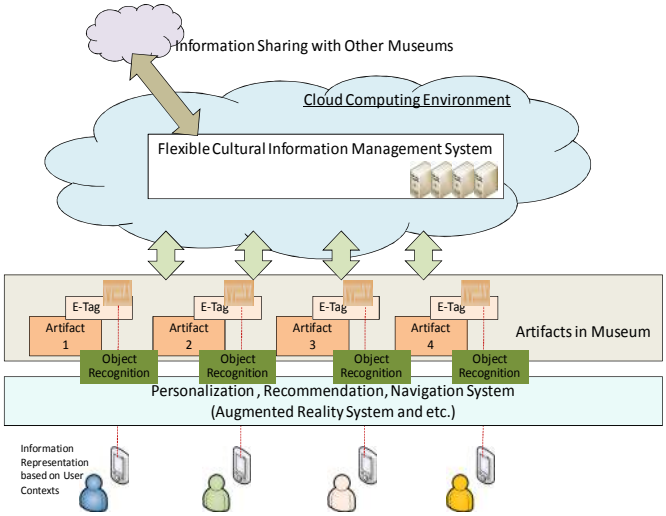

Figure 1: An Illustration of the Proposed System Architecture

information for each artifact as flat information (non-structural information). In other words, they can create or put any kind of information to the databases without concerning any metadata standard or ontology. All they have to do is to create [Aggregation Link] which is the link for integrate information for each artifact, and [Relation Link] which is the like for represent relation between information. In other words, the system considers user profile and user behavior, and then provides the information of each artifact by using the Aggregation Link. As a result, each artifact can have various kinds of information representation methods. According to the Relation Link, the system can provide or recommend further artifact information. Furthermore, full text search with text mining method is used for information retrieval in the proposed system. In other words, information representation in most museums is static, but in our proposed system the representation can be dynamic.

One of important components for the proposed information management system is artifact ID management system, and the system diagram is shown in Figure 3. In the system, there are single global ID database which use for managing ID prefix for all museums around the world, and private ID databases which use for ID management in each museum. First, museums will register to receive ID prefix. Subsequently, each museum will assign ID suffix to each artifact and manage the ID by itself. To be noted that in the system, each artifact will have only one unique ID.

3. System Implementation

In order to realize the above architecture, we build a simple and small cloud computing system environment in GITS Honjo campus. In this system, we apply Hadoop Distributed File System (HDFS)[6] which is the open-source version of Google Distributed File System. We also use column-oriented database (HBase) not relational database. Because in the column-oriented database, we don't have to concern any schema of the database or structure of the data. In other words, anyone can put any information easily without considering any information structure. The HBase is also put on the top of HDFS. An illustration of system implementation is shown in Figure 4.

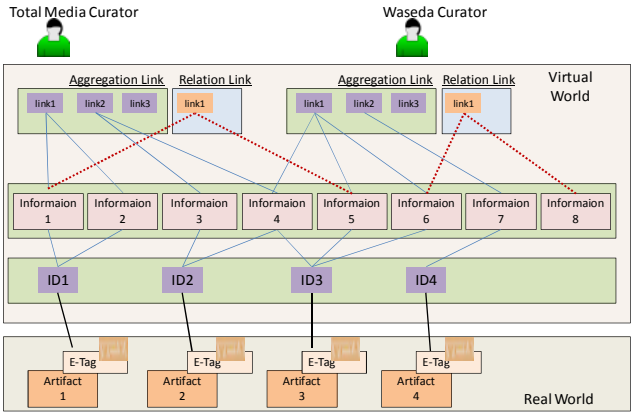

Figure 2: Flexible Information Management System

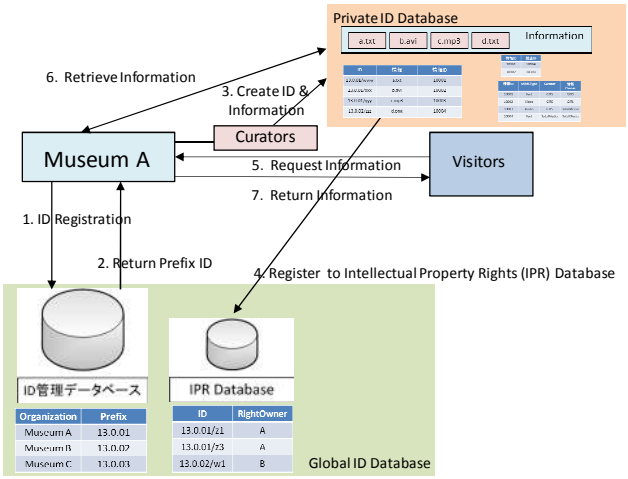

Figure 3: Artifact ID Management Diagram

According to our implementation system, we build clustering servers which include one master and four slave nodes. All contents (text, image, audio, video) are transformed to bytecodes and be copied to slave nodes in the system while metadata or contents address is being processed in the master node as well as assigning the job for each slave node. As be seen in this figure, even some of slave nodes down, the contents are still available. In other words, the cultural contents can be permanent preserved.

We are also installed Tomcat Web application server and created a web application program for the system evaluation.

According our preliminary implementation, one of big limitation in this architecture is query performance. It could not provide complicated query like SQL. Hence, we include auto index system and it is automatically indexing when contents are uploaded as well as full-text searching function in order to increasing searching capabilities.

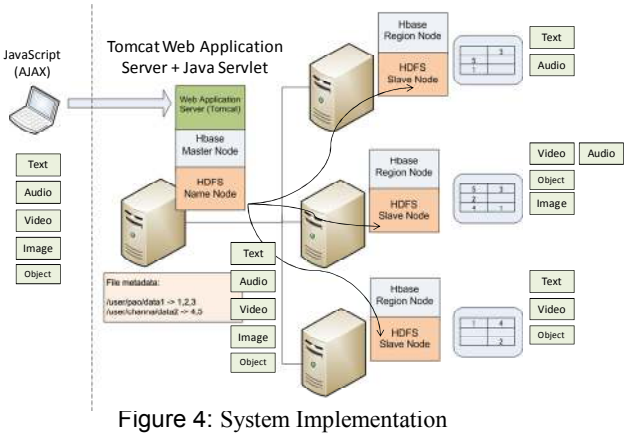

Figure 4: System Implementation

4. Conclusion and Future Works

In this paper, we introduce our proposed flexible information management system for museums. The proposed system can provide diversity of information with dynamic representation. Subsequently, the detail of implementation system is described as well as information query limitations. In our first experiment, HDFS and HBase are applied to build a cloud computing environment, and the auto indexing system is also included in the system to increase query performance. However, the experiment in this paper is just preliminary works, and there are many issues needed to be tackled with. For instances, the web application interface for management cultural information is needed to be modified based on museum curators perspective. In addition, methods of system evaluation will be studied to verify the effectiveness of the proposed architecture.

References

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