S16-3
XML-based Information Model for Interactive Electronic Technical Manual for Urban Regeneration Project

Sunghoon Kang[1], Hyun-Soo Lee[2], Moonseo Park[3], and Jin-Wook Jung[4]

[1] Master Course, Seoul National University, Seoul, Korea
[2] Professor, Seoul National University, Seoul, Korea
[3] Professor, Seoul National University, Seoul, Korea
[4] Master Course, Seoul National University, Seoul, Korea
Correspond to hun626@gmail.com

ABSTRACT: Recently, the construction industry is getting more complex and sophisticated having the characteristics of a mega project. Mega project pursues a value that can't be gained with an approach of seeing a project as just a simple sum of different parts but a mutual combination. However, the current manuals can't fulfill the needs for supporting, therefore, need a tool to support the decision making and an IETM is expected to take this role. Despite the a lot of expected advantages of IETM, it is still difficult to apply because of the frequent changes of information of detailed process and its complexity. In this research, as part of developing an IETM, we aim to propose a system frame which is based on the analysis of processes of a project. It is basic part of IETM to give information to users and IETM consists of normal mode that offers general information about the urban regeneration project and user-specified mode that gives classified and reorganized information to user. For supporting these functions, IETM should be stored in a form that can classify the information about urban regeneration project and be tagged with meaningful tags. Moreover IETM developers have to consider the interoperability of IETM because it ultimately should be coordinated with overall Project Management System like an iPMIS. We used XML for solution of interoperability because it stores information as just text-file that doesn't need a special form.

Keywords: IETM; Urban Regeneration; XML; Information Management

1. INTRODUCTION

1.1 Research Goal

It needs a specialized management tool to operate a mega project like a urban regeneration because of its complexity and sophisticate characteristics. Current urban regeneration projects are conducted by some specialists who have worked for long periods of time. Therefore, the operation processes of urban regeneration are so inefficient and are likely to fail.

According to the survey, all survey participants who have enough experience for the urban regeneration project said that there are so many difficulties for operating urban regeneration project. For the question about the priority of the difficulties, 38.5 percent of the 59 people said 'communication with various stakeholders' and 30.8 percent said 'complicate process and problem related with laws', and another 15.4 percent said 'insufficient understanding between law system and stakeholders'.

Despite of these difficulties, Researches about the decision support of mega projects like an urban regeneration are insufficient. all respondents except for one had a paper-based manual said that they didn't have any kind of operation supporting manual in their companies.

The reason why the researches are inactive is that there are some restrictions for developing the decision supporting system like an IETM for mega construction projects.

Most information of the mega construction projects is related with laws. Technical manuals mainly used in mechanical fields like digital devices are inefficient, though, because laws are not easy to understand and changed frequently.

In addition, making technical manual with the newest information is wasteful work. Therefore, researches for the IETM which can deal with the information changeability are necessary.

1.2 Research Scope and Methodology

Technical manual which mainly used in mechanical fields are focused on providing adjusted information which as the basic function of manual.

It is insufficient to give information as the initially formed contents, though, because urban regeneration projects have features like changeability or complexity through various stakeholders.

Therefore, we are carrying out research on the methods for supporting user specified functions as well as just providing adjusted information in this paper.

To provide user specified functions, firstly we are going to discuss the methods to develop an XML-based information model. And, secondly will talk about the methods to automatically create IETM framework for a mega project which reflects the features of urban regeneration project like a territory or owner. The facts that laws are not took shape logically and constituting framework for a specific project is wasteful work make this research valuable.

Finally, we will develop a prototype of IETM for urban regeneration projects and discuss the usability and effectiveness.

2. BACKGROUND OF RESEARCH ON IETM

2.1 Research on IETM in other fields

The research on IETM has been pioneered by the Department of Defense of U.S. in the development of IETM concept as well as in the establishment of its standards.

A digital manual, which is commonly called an Interactive Electronic Technical Manual (IETM), was developed for the diagnosis and maintenance of a weapon system, optimally arranged and formatted for interactive screen presentation to the end-user.

There have been many researches done about different IETM applications and their effectiveness in DoD environment.

In Korea, researches on IETM are becoming active for general part of industry as well as military areas. They aimed at reducing manual management expense and information retrieval time and make efficient business environment and virtual reality(VR)/XML/computer base training (CBT : Computer Based Training), advanced technology of human computer interface(HCI : Human Computer Interface) etc.

The research on developing IETM in Korea is actively being conducted by leading companies like GREENBELL SYSTEMS and IT SCIENCE and the research is mainly focused on the military supporting systems or mechanical devices like digital camera, refrigerator, personal computer etc.

2.2 Information Classification in Construction Fields

It is important to standardize the administrative information for an effective performance of mega project. A work breakdown structure (WBS) is a predominant code system focused on the work operations and most mega projects used to use unique WBS code system. However, detailed process of mega projects are so diverse that couldn't be an appropriate solution.

BBS code is classified and focused on the function oriented activities, such as time scheduling, cost management, quality management and resource management.

It classifies those detailed management information for each CM task as a standard breakdown structure so that system manager can access and reuse those information through project lifecycle.

Recently, the necessity of a systematic business information management for CM tasks as well as operation data management for construction work processes is recognized. Especially, business information management is getting more attention because construction project are getting bigger and more complex

and CM scope is being extended to the life cycle of a project from the planning phase to the completion and maintenance phase.

According to Kang (2005), it is important to standardize the information generated from the process of construction projects. BBS is designed for classifying the detailed process information and can be a useful tool for standardizing the administrative information of construction projects.

Although BBS is a prevalent classification code system, it doesn't mean that IETM should be classified according to existing BBS for construction project. It only means that IETM information should be classified in any format to organize and reuse for a specific user.

2.3 XML-based Data Integration Technology

XML is a fundamental internet technology standard that was officially issued by W3C in 1998 for improving the data integration of diverse software system.

Software implementations based on XML which allows structured information to be organized and stored within a text file are practical and cost effective because it could work on any computer hardware and operating system platform and with any software program. It is a set of rules that allows you to define structured information in a text file.

The reason why XML commonly used on most web sites is that it is derived from the ISO 8879 Standard Generalized Markup Language (SGML) like Hyper Text Markup Language (HTML). So, The World Wide Web Consortium (W3C) defined XML as a recommended internet standard in 1998.

HTML, XML are all text-based and tagged but the difference between HTML and XML is "interpretability of tag" in which information is enclosed inside markup tags.

Actually, each individual firm can apply its business rules flexibly to XML based system. System manager converts its information to XML documents through XML-based interface, and then sends the information to other system.

According to Sunkpho (2005), existing field inspection activities are supported by paper-based manual. So, XML-based Field Inspection Support Systems is thought to improve the supporting process. However, it needs to spend much money and time on constituting a manual for each project due to the lack of generality of Inspection information. Therefore, semiautomatic methods to generate specified Inspection application by using Java Inspection Framework (JIF) for an inspection support system are developed.

For help to support those inspect activities, they suggested that the system has to be customized to recognize the specific inspection tasks being performed and knowledge-based contexts of the inspection. The definition of task in that research is an activity that has to be performed during an inspection. And each task is composed of a set of inspection domain objects, which include inspection data, inspection elements, inspection knowledge, and instruments. Each piece of inspection information can be stored in an XML document.

Baomin (2007) suggested XML-based Port Logistics Information System (PLIS) as an information integration method by applying the features of Façade Pattern Interface and Web Service Data Exchange Platform. The author also developed an information integrating framework for PLIS and suggested that XML based approach can improve the problem of compatibility between comprehensive PLIS and complex subsystem.

2.4 Analysis Result of Research on IETM

The result of the literature review explained that precedent researches on IETM have been focused on simplifying the contents and showing the adjusted contents visually. However, this basic function cannot satisfy the diverse needs for supporting urban regeneration business. So, information should be organized for giving user specified function.

For organizing the information, information have to be stored in database by classified form. As a part of classifying efforts, researches on BBS for construction fields have been conducted.

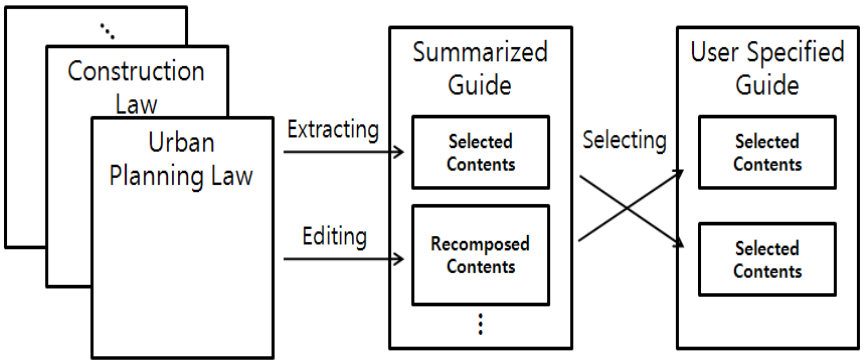

Fig. 1. Overall Process to Compose an Adjusted Manual

In addition, there are some researches on XML-based information integration methods. As mentioned above, the traditional system based on the fixed business standard sets cannot satisfy to the needs of dynamic

integration. As a result, the resource in these subsystems are characterized by uncertainty, disperse distribution and partial secrecy. Compared with the data integration methods based on traditional HTML technology, XML technology separates the business rules from the extensive data, so that system manager can apply its business rules flexibly.

Due to the Rich flexibility of XML in the interaction between the isomerism systems, the XML document can be treated as information exchange medium to realize data sharing and the information integration.

3. IETM PROTOTYPE FOR URBAN REGENERATION FIELDS

Giving information to users is basic function of IETM, but it is insufficient. So, IETM should consists of normal mode that offers general information about the urban regeneration project and user-specified mode that gives classified and reorganized information to user.

For supporting this function information of IETM, it should be stored in a form that can classify the information about urban regeneration project and should be tagged with computer interpretable "tags".

In addition, IETM developers have to consider the interoperability of IETM because it ultimately should be coordinated with overall Project Management System.

3.1 Process Map of Urban Regeneration Business

Owing to the law-making process which considers the complex law-related problem, it is not easy to understand law at once. Therefore, urban regeneration projects used to be conducted by few experts and highly dependent on them.

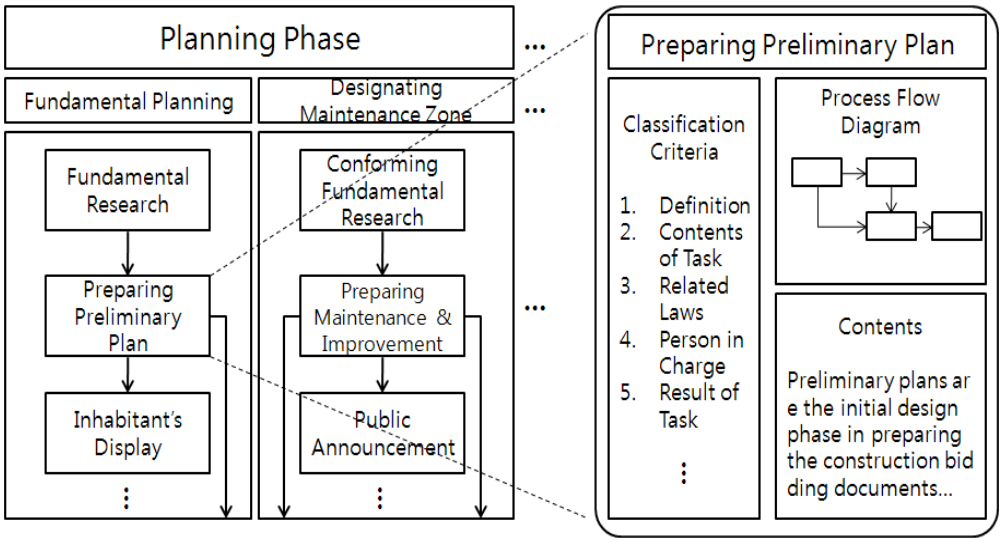

Fig. 2. Process Flow Diagram for Urban Regeneration Projects

For improving this monopolized situation, we reshaped the abstruse process of urban regeneration projects and made a process flow diagram.

The figure 1 shows the overall process to compose an adjusted manual and the figure 2 shows the process flow diagram for urban regeneration projects. It consists of 4 parts, which are planning, construction1, construction2, and completion phase.

Each phase consists of detailed processes and contains information about the sequence of the processes. In addition, every detailed process informs the contents classified by several criteria to users.

3.2 System Architecture

The figure 3 shows the system architecture of IETM prototype for urban regeneration business. We supposed that IETM should have its own database and be compatible with comprehensive project information management system. Interior database of IETM consists of database that contains general information of IETM and file server which contains kinds of application form or contracts etc. IETM can exchange information with other system, agreed in advance, like a KMS by retrieving the database.

Although, IETM prototype in this research is based on XML data, existing information for urban regeneration projects is paper based. So, existing information should be converted into XML data.

XML converter reduces the resources to change text based information and paper based information into XML-based text file manually. After this XML converting step, users can get the organized information.

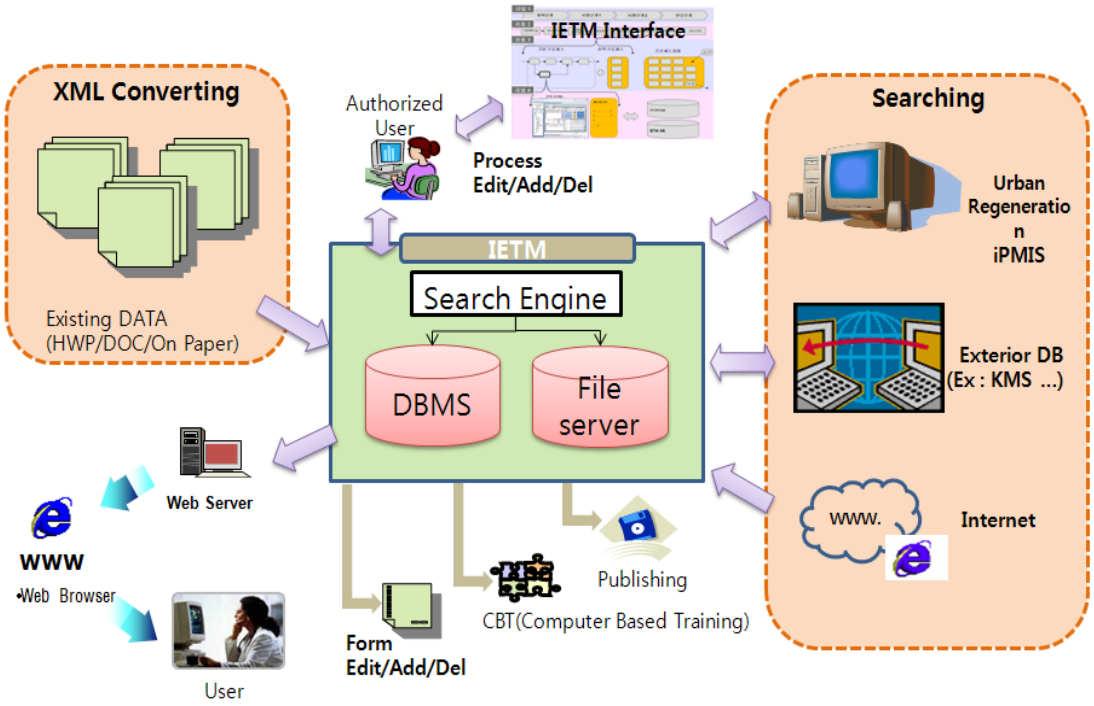

Fig. 3. System Architecture of IETM for Urban Regeneration Projects

3.3 IETM Prototype for Urban Regeneration Projects

This section illustrates the prototype of IETM for urban regeneration projects. As mentioned above, it offers a process map of the urban management law to users. In addition, users can modify the process map and search the information in other system from the searching tab. And the system can support users with the functions like 'decision making' which offers checklist function or 'conflict management' which shows the precedent conflicts for each specific process.

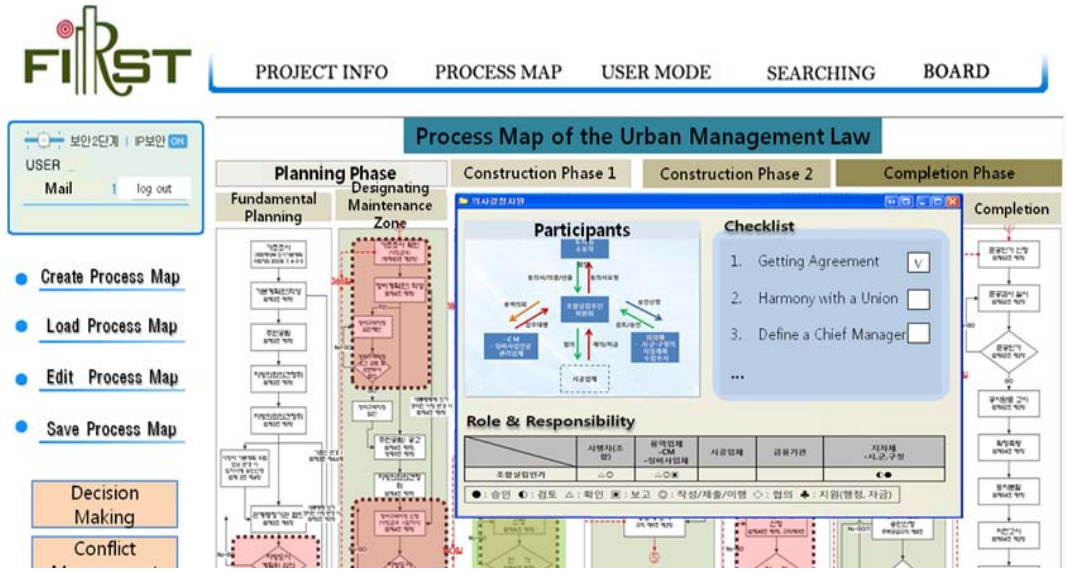

Fig. 4. IETM Prototype for Urban Regeneration Projects

4. INFORMATION MANAGEMENT FOR IETM

As mentioned above, IETM is a tool can support users to carry out mega projects. The process information can be modified in the prototype, it can be used continuously.

Unfortunately, however, using the IETM continuously is not so simple. It needs the cutting-edge law-related information and manually updating the urban regeneration related laws and general information is wasteful and impossible.

Therefore, research on technologies for dealing with changeable law-related information is needed.

4.1 Changeability of the IETM Information

Laws for the urban development are changing periodically and detailed contents can be changed by the way. Even the whole frame of urban development laws can be modified every 5 year or 10 year.

IETM consists of edited information for improving comprehensiveness for the process of mega projects. So, it is impossible to automatically modify the information as a simple links and doing it manually is ineffective. Therefore, researches on semiautomatic IETM information modifying methods are indispensable.

Notifying that there are some law-related information changes can be beneficial to a system manager by holding the link information of the each process. However, to find the links between the processes is obscure. Some links between the processes are direct links which can be clearly distinguished. But, unfortunately, there are a lot of invisible links between the processes.

For example, the change of the higher level of laws could affect the lower level of laws which have lower priorities.

To improve these uncertainties of law changing processes, law changing processes should be classified into some kinds of pattern. If the law changing processes patterns are found, like that laws related to 'Fundamental Planning' can affect 'Approve' process of the Construction phase, it could make notifying to system managers what specific processes should be changed possible.

4.2 XML for Modeling IETM Process

```
<?xml version="1.0"?>
<!– File Name : Urban Regeneration.xml →

<!DOCTYPE COLLECTION
   [
   <!ELEMENT ProcessName (#PCDATA)>
   <!ELEMENT DatachangingPattern (type a, type b, type c...)>
   <!ATTLIST DatachangingPattern Status (edit | remove)>
    .
    .
    .
   <!ELEMENT InfluencingProcess (#PCDATA)>
   <!ELEMENT InfluencedProcess (#PCDATA)>
```

Fig. 5. Anticipated Contents of XML DTD

Law changing patterns which are gained as a result of the section 4.1 should be stored in XML Data Type Definition (DTD) or XML data schema which contains the attribute value of XML data.

The figure 5 shows the anticipated contents of XML DTD which is not determined yet because the Classifying work is in progress.

5. CONCLUSIONS

Currently, construction industry is getting more sophisticated having the characteristics of a mega project. So, the needs for business supporting manuals are increasing. But, using the technical manual which mainly used in mechanical fields cannot support the business of urban regeneration fields.

It is insufficient to give information as the initially formed contents, though, because urban regeneration projects have features like changeability or complexity through various stakeholders.

Therefore, we carried out research on the methods for supporting user specified functions as well as just providing adjusted information. To provide user specified functions, firstly we discussed the methods to develop an XML-based information model. And, secondly we talked about the methods to automatically create an IETM framework for a mega project which reflects the features of urban regeneration project like a territory or owner. Finally, we introduced a prototype of IETM for urban regeneration projects and discussed the usability and effectiveness.

However, there are some restrictions for using the IETM for urban regeneration projects. It needs some technologies for dealing with changeable law-related information and XML-based techniques will be considered to improve these problems

ACKNOWLEDGEMENT

This research supported by a grant (07UrbanRenaissanceA03) from High-Tech Urban Development Program funded by the Ministry of Construction & Transportation of Korean Government.

REFERENCES

[1] Ali N. Karabulut, Hilmi Oz., "How to Develop an Interactive Electronic Technical Manual: An Industry Perspective", AIR FORCE INST OF TECH WRIGHT-PATTERSONAFB OH, 1998

[2] A conceptual framework for classification of construction works, Anders Ekholm, Dr Div. of CAAD, school of architecture, lund University, Lund, Sweden

[3] "The standard for program management", Program Management Institute, 2006

[4] Jirapon S., James H., Garrett Jr., "XML-Based Inspection Modeling for Developing Field Inspection Support Systems", journal of infrastructure systems, 2005

[5] Baomin M., Qing L., Guangqi S., "An XML-based Data Integration Method For Port Logistics Information System", international conference on transportation engineering, 2007.