A study on the construction of GIS component repository system

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Abstract

The most main current of software industry tends to focus on the area of component. In this situation, software industry in GIS (Geographic Information System) also becomes an interesting issue by performing a large scale of national GIS application development as well as even small scale of FMS (Facility Management System). In order to develop those system efficiently, there should be deep consideration not only component development and but also component management.

In this paper, these components are classified based on their particular rule, especially considering GIS component, before cataloging them in repository. Here Web-based GIS Component Registration and Retrieval System is implemented then the cataloged component will help application developers to select easily their desired component and new component may be re-produced by modifying and combining previous components and system.

Finally, the original goal of this all effort is to have high reusability and interoperability by using previous GIS component.

Keywords: GIS (Geographic Information System), Component, Repository, Web, Reusability, Interoperability

Introduction

Recently many software engineers have focused on component research to increase its reusability and interoperability. Especially, the research of common repository system for architecture technology, management and development has been regarded as a hot issue because it can save time and manpower by accessing to exactly what system developers are looking for. (Han, 2002)

Usually system developers tend to spend much of their time and effort to find out certain functionality for the implementation of their preferred style. Also, they want to obtain guaranteed component to improve their system productivity and quality at the same time. (Kim, 2000)

However, as you may know, it is very difficult to identify certain components in a repository because of the lack of quality of software components and the inability of developers to efficiently find them. Here, in order to solve this problem, establishing fully repository architecture on the web for component sharing and circulation should be encouraged in a proper way.

In addition, to implement GIS more efficiently in the view of cost and time, GIS developers started to consider the concept of GIS component repository on Web. It is mainly focused on reusability and interoperability because most GIS projects have its certain application such as MIS (Marketing Information System), ITS (Intelligent Information System), LIS (Land Information System), DCS (Disaster Control System) and FMS (Facility Management System) and each application needs its common functionalities such as mapping and query or its certain functionality such as 3D viewer and GPS data processing. Therefore, if there exists a universal repository storing GIS components and system designers or developers know where desired component are located in real time, they can easily select their desired component then modify or composite to their system by using them. (Han, E. J. 2002)

In this study, in order to develop and manage effective web based GIS component repository system, component-based development methodology is proposed. This methodology, which assembles component then produces software, is considered as an epoch in the view of economy and efficiency. The biggest merit is to save expense and time to be expected to spend for development of software. Moreover, the development process, which has life cycle from requirement and domain analysis to maintenance, is proposed in the view of reuse. Therefore, the components proposed in this study can do “plug and play” for other calamity obstruction system, which is similar to our system, also has reusability and transplantation.

Finally, in this study the mot significant thing will analyze and design web based component repository for public use of GIS component so that the overlapping of investment can be prevented while maintaining the quality guaranteed of component.

The construction of GIS component repository system

In this study GIS component repository system is constructed to resist and retrieval GIS components depending on its metadata defined in web environment. Also, all GIS components stored in repository are managed through its UID.

In fig. 1 show the main concept diagram of web based GIS component repository system. People input their keywords on retrieval interface and this keywords information goes to be matched in to DBMS through using GIS component metadata specification.

GIS component metadata specification has tree big categories. First of all, GIS data source component, which has purpose to acquire interoperability among spatial data format constructed under heterogeneous environment. Secondly, GIS functionality component, which can be used as the kernel of GIS by developing certain GIS application software. There exist general GIS functions such as map display, and attribute display also exist certain GIS functions such network analysis, 3D analysis, and authority. Third, GIS application component, which shows several GIS domain such as MIS(Marketing Information System), FMS(Facility Management System), DCS(Disaster Control System), ITS(Intelligent Transformation System), UIS(Urban Information System) and LIS(Land Information System). This functional GIS component classification architecture indicates the view of vertical GIS component and it will help to catalog them in a repository. (Jo, Y. W. 2002)

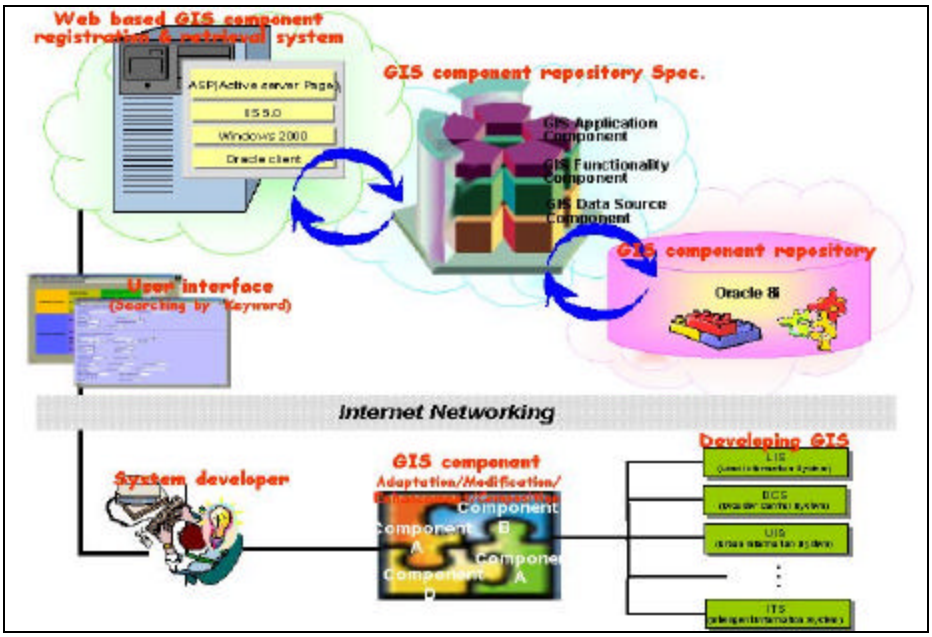

Fig. 1 The concept of study

The analysis and design for the system

Fig. 2 shows the main idea of entire system operation flow. This support all logic needed to implement system especially, scenario description, use case diagram, the sequential diagram, class diagram, and activity diagram.

In this paper in order to design and analyze system more extensively and effectively, the component development methodology was used as main development methodology. To present all this methodology more objectively, there are 4 diagrams.

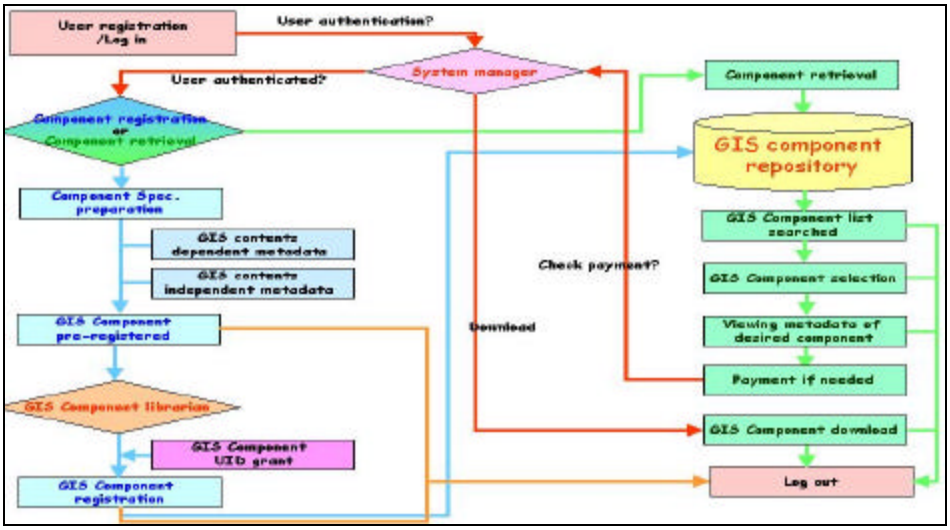

Fig. 2 The system development analysis

The following fig. 3 shows the scenario description of web based GIS component repository. This scenario explains the actions of user case and helps to understand the goal and contents for entire system process.

When users want to register or retrieval desired GIS components, he/she connects web-based GIS component registration & retrieval. To log in to this web site, each user makes a user registration then stores its personal information to server.
When users want to register a new GIS component, they prepare its GIS contents dependent metadata and GIS contents independent metadata then make pre-registration through component registration screen. Each GIS components pre-registered are given UID(Unique ID) by system manager then stored in GIS Component repository.
When users want to retrieval a new GIS component, they input absolute key word(GIS contents dependent metadata) and additional key word(GIS contents independent metadata) through component retrieval interface. Then he/she selects one of them on a retrieved list and look up its metadata. If needed, they pay for their desired GIS component then download them.
Finally, they log out.

Fig. 3 The Scenario description

Use Case Diagram indicates system actor, system function, and circumstance. Fig. 4 shows

the use case diagram of web based GIS component repository system. Sequential diagram is to delivers component interface by presenting steps & messages as time goes as show in fig. 5.

Fig. 4 The use diagram

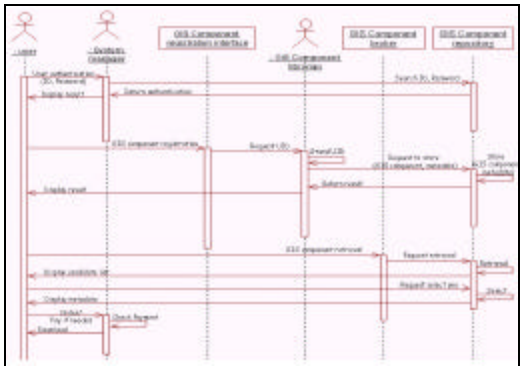

Fig. 5 The sequential diagram

For the class diagram, the collaboration among the classes should be first defined. Fig. 6 shows the class diagram based on use case diagram, and sequential diagram. Activity Diagram is to understand entire user's requirement in its desired domain as show in fig. 7.

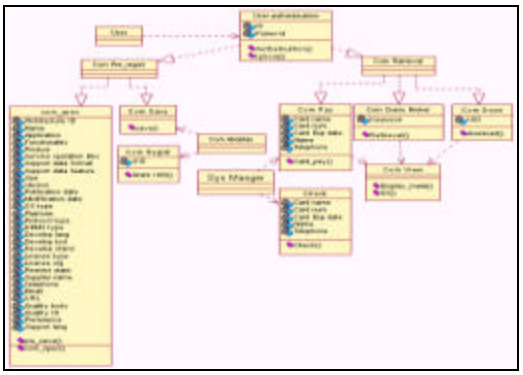

Fig. 6 The class diagram

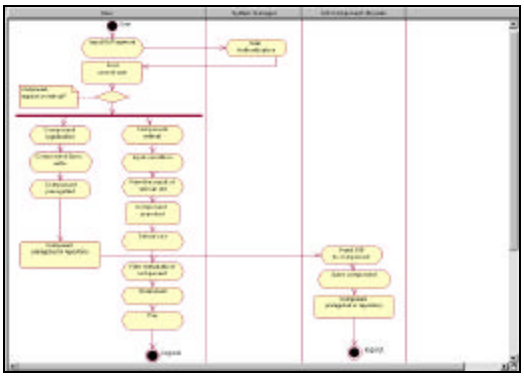

Fig.7 The activity diagram

The prototype of web based GIS component repository system

In this paper, the prototype of web based GIS component repository system is shown considering to one certain component, whose UID is Fun_2FDRV(GIS Functionality of Forest Fire Danger Rating Viewing component). The main goal of this component is to service web based forest fire danger rating on map. (Jo, 2002)

Fig. 8 shows the prototype of web based GIS component registration & retrieval function. In order to implement this prototype of web based GIS component repository system, Oracle 8i is used as DBMS and Java and HTML are used as development language, respectively. When GIS component is resisted, the GIS contents dependent metadata are required mandatory. Also,

component UID is be considered not to repeat in a repository after certain GIS component librarian.

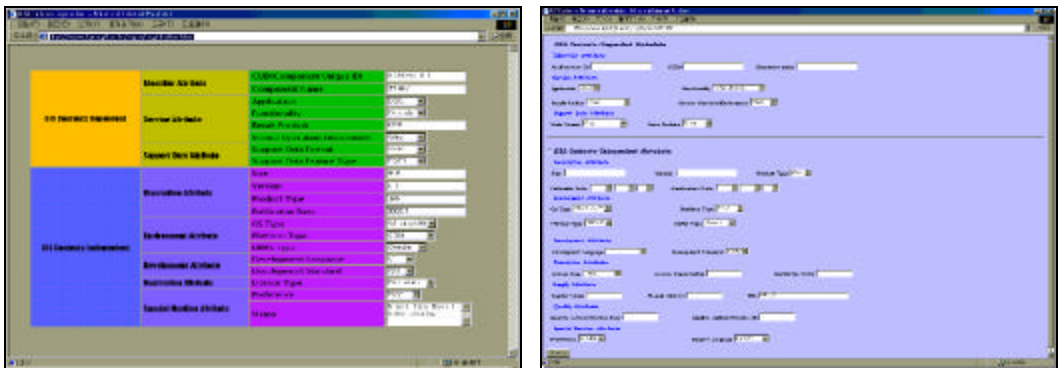

Fig. 8 The prototype of GIS component registration & retrieval function

Fig. 9 tells the prototype of result after operating web based GIS component repository system, which is shown above. Here, the retrieved GIS component was 2FDRV.

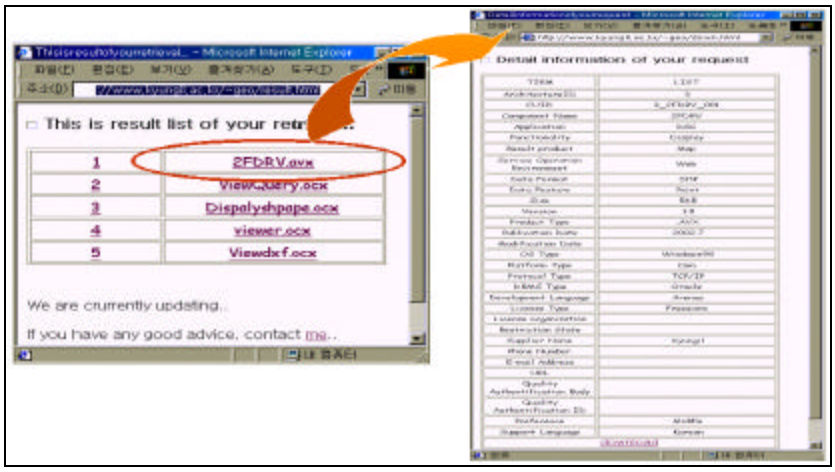

Fig. 9 The prototype result of web based GIS component repository system

3. Conclusion

Recent paradigm of software engineering tends to focus on developing component, which considers reusability and interoperability. In addition, it considers storing them in a repository, managing, and deploying in various business domains such as financial system and manufacture system.

In this paper, in order to develop and manage effective web GIS component repository system, the development process is fist proposed in the view of extension. For this, the component

development methodology was used and 6 diagrams such as scenario description, use case diagram, the sequential diagram, class diagram, and activity diagram.

In order to increase component reusability and interoperability in GIS domain, in the further this system should be considered for GIS component repository spec using not only metadata described here but also further extended metadata.

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