DESIGNING AND DEVELOPING E-MAP COMPONENT USING UML

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ABSTRACT:

In this study e-map component was designed and developed to possibly overlay with all kinds of thematic maps in various scales and provide the all detailed information by using high-resolution satellite image and GIS. Also, this system has powerful map composition tool to display map such as legend, scale bar, index map and so on.

For this, this e-map component was designed by using UML and developed based on Windows 2000 and implemented by using Visual Basic 6.0 as development programming language, Map Objects 2.1 of ESRI as GIS component.

Through this system, the forest officials could generate more detailed topography and desired thematic map. In addition, the data consistency in DBMS could be maintained by using SDE (Spatial Database Engine) for their job and share the standard forest database with others in real time.

KEY WORDS: e-map component, overlay, high-resolution satellite image, GIS, UML

1. INTORDUCTION

To improve the reusability and interoperability of GIS components, we propose the registration/retrieval agents, which can search the locating of users' frequently used components in not only the GIS domain but also other spatial information technologies such as GPS, ITS, RS and FM [1].

Recently the domestic technologies to manage forest and to control all related information were developed very rapidly by integrating and IT. However, there still exists a mapping problem for example when overlaying a topography maps scaled in 1/5,000 to a forest type map scaled in 1/25,000[2].

In this situation, there is a greater need to develop 3D high-resolution forest mapping system, which can mange even detailed information about forest through using advanced spatial technologies such as high-resolution satellite image and GIS [2].

In this study e-map component was designed and developed to possibly overlay with all kinds of thematic maps in various scales and provide the all detailed information by using high-resolution satellite image and GIS. Also, this system has powerful map composition tool to display map such as legend, scale bar, index map and so on.

For this, this e-map component was designed by using UML and developed based on Windows 2000 and implemented by using Visual Basic 6.0 as development programming language, Map Objects 2.1 of ESRI as GIS component.

The result of constructing this system helps to manage domestic forest scientifically and effectively within shorter time then reduces support the standard for domestic forest information. Finally, this system is expected to become the foundation of scientific and effective domestic forest policy.

Finally, the additional main objective of this study is acquired GIS component, which is regarded as enabling interoperability and reusability within the GIS industry and mainstream information systems industry, but also to manage GIS component in the universal repository.

2. DESIGING THE DEVEMPOENT PROCESS FOR E-MAP COMPONENT

E-map component developed in this paper presents possibly overlaying with all kinds of thematic maps in various scales and providing the all detailed information by using high-resolution satellite image and GIS. Also, this system has powerful map composition tool to display map such as legend, scale bar, index map and so on.

In order to develop this, CBDP (Component Based Development Process) was proposed in this paper. This development process tried to emphasize the view of reusability so that it has lifecycle, which starts from requirement and domain analysis and finishes to component generation. Moreover, The concept of this development process tries to reflect component-based method, which becomes hot issue in software field nowadays.

Fig. 1 shows the development process, which contains domain analysis (Scenario description, FA description, User Case diagram, Conceptual diagram, Sequential

diagram), Component design (Class diagram, component diagram), and Component generation [1].

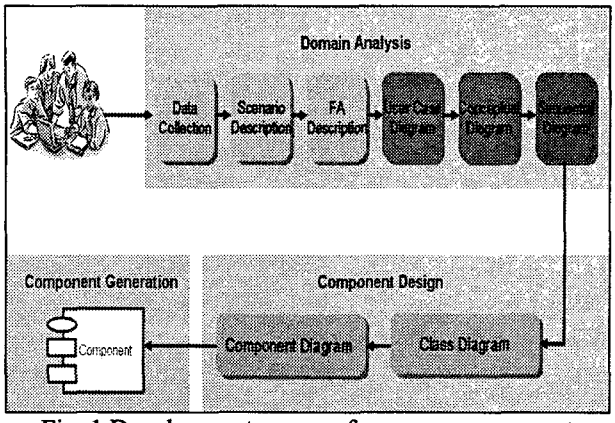

Fig. 1 Development process for e-map component

3. APPLYING THE DEVEMPOENT PROCESS FOR E-MAP COMPONENT

3.1 Domain Analysis

In this domain analysis step, there are 5 sub-steps to produce and design e-mapping component, which are called as scenario description, Function/Attribute description, use case diagram, concept model, and sequential model.

3. 1. 1 Scenario description

It presents a real domain to understand user's requirements. Plus, it describes UML notation, which does not depend on a specific diagram.

Table 1. Scenario description

This forest mapping system was developed to overlay the various thematic maps especially 1m high-resolution satellite images (IKONOS). Also, the main focus of this system is to have the fundamental GIS interface such as measuring distance and area and zoom in/out/pan, the retrieval interface for spatial and attribute data, the GIS analysis such as buffering, the interface to modify spatial data and its attribute data, the interface to provide media data and the interface to construct 3D high resolution forest map. Especially, this e-mapping component is the interface to ovary 3D high resolution image with various thematic maps and compose map book including map title, map, legend, index map, scale bar and forest type.

3. 1. 2 Function/Attribute description

This table 2 shows the desired function and attribute to build up e-mapping component.

Table 2. Scenario description

Functionname	Explanation	Category	Attribute
getArea()	Set Area	E-mapping	Kujwa, Aewol, Hanlim, Chonch'on, Chuja
getThemeMap()	Set Main map	E-mapping	Digital topography map, Forest land map, Forest type map
getTitle()	Set Title	E-mapping	User assignment
getMapName	Set Map name	E-mapping	1/5,000, 1/25,000, User assignment scale
getGuide()	Map Guidebook	E-mapping	User assignment
getLegend()	Map Legend	E-mapping	Sample point, Forest land, National roda, Local road
getDecode()	Map Decoding illustration	E-mapping	School, Road, River, Apartment, Forest land
getForest()	Map Forest guidance	E-mapping	Confusion, Acicular tree, Broadleaf tree, Crown density
getLandform()	Map Landform	E-mapping	DEM, Hillshade, Contour
getZone()	Map Administration zone index	E-mapping	Satellite image index, Administration index, Map index
getCoordinate()	Map Coordinate	E-mapping	X Coordinate, Y Coordinate
getScale()	Map Scale	E-mapping	1/5,000, 1/25,000 scale

3. 1. 3 Use case diagram

It employs use cases purely as a technique for describing the desired user system interactions that occur at the system boundary. It identifies the actor, which can be regarded as users, other systems, and its circumstance based on terms defined in conceptual model.

Also, the function of system, which calls as use case, can be identified in the view of actor. Finally, the model used to extract and analyze user requirement is drawn for the function of system. At the same time, the boundary and role for desired component are decided.

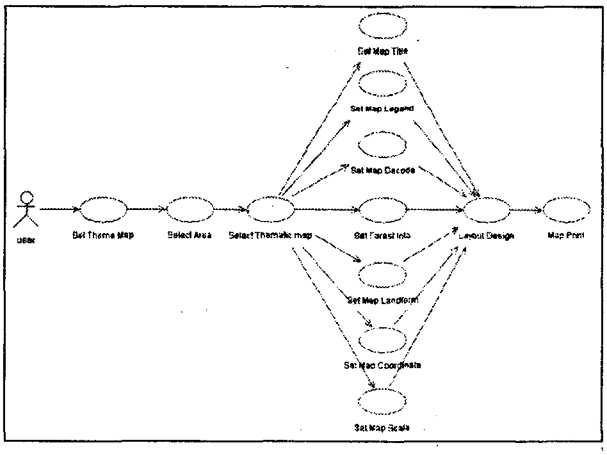

Fig. 2 Use case diagram

3. 1. 4 Concept model

Main purpose of this is to capture concepts and identify relationships between terms & rules as a model of information that exists in the problem domain.

It tells desired information simply in problem domain. There is necessary to understand terms used in problem domain and to draw class diagram to capture entire concepts. This is derived from "Designation", which is emphasizing the relationship between terms and rules.

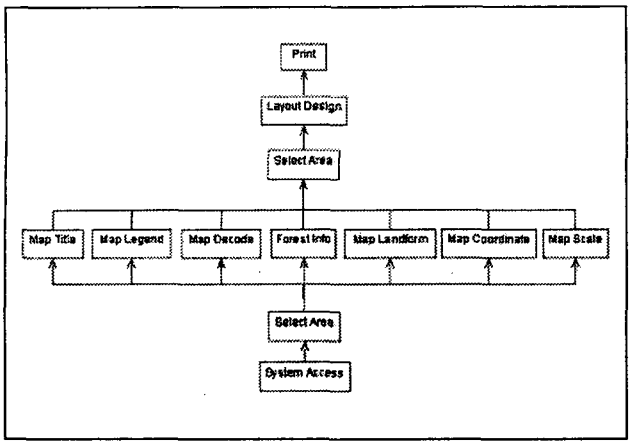

Fig. 3 Conceptual diagram

3. 1. 5 Sequential models

The purpose of the sequential model has a worthy history in computing. In the sequential model, use case predefined is divided into several steps then operations are identified in each step.

Thus, it derives interface. Finally, core logic can be extracted by implementing component to support. In this model, component interface is to identify easily by presenting steps and message described sequential diagram.

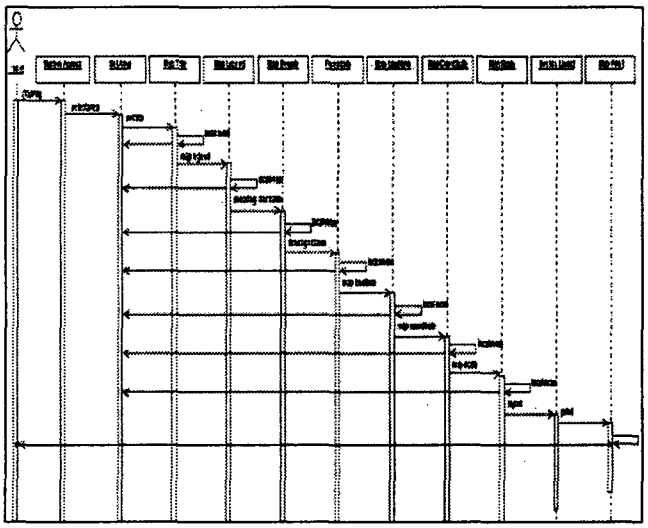

Fig. 4 Sequential diagram

3.2 Component Design

In the component design step, there present resources to build up component or system and then generate class diagram and component diagram.

3. 2. 1 Class diagram

The class diagram has attributes, constrains, assignment, responsibility to develop e-mapping component. Through this diagram, the relationship among classes should be first defined.

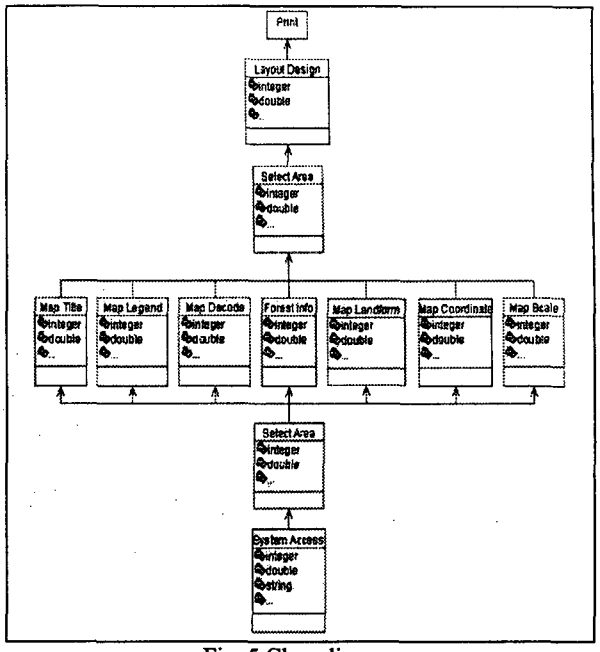

Fig. 5 Class diagram

3. 2. 2 Component Diagram

The component diagram defined here could be re-used and perform Plug & Play with other similar allocations.

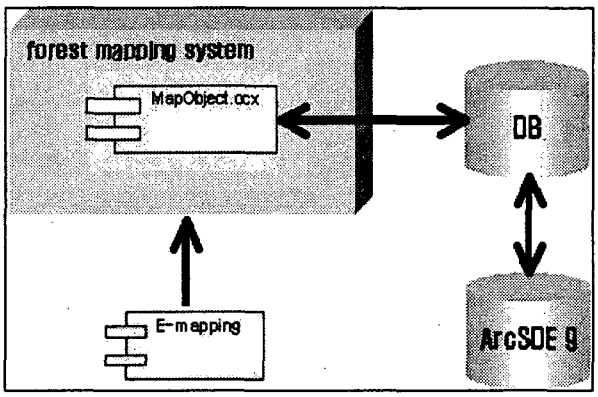

Fig. 6 Component diagram

3. 3 Component Generation

Component can be generated through customizing and combining previously implemented components and new intended product can also be constructed by integrating components, which are the results of architecture identity and component identity.

1) Correction: component can be modified in proper way for its original goal. 2) Adaptation: component can be adapted to accept new circumstance such as new processor, new operating system, new peripheral equipment, and new protocol. 3) Enhancement: component can be added to make better operation, user interface, and performance.

4. SYSTEM DEVELOPMENT

This system was developed based on Windows 2000 and implemented by using Visual Basic 6.0 as development programming language, Map Objects 2.1 of ESRI as GIS component and Oracle 9i as DBMS, respectively under intranet network environment [2].

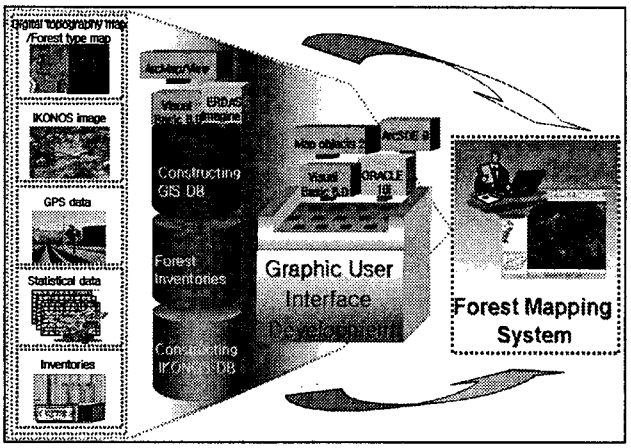

Fig. 7 System development diagram

Fig. 8 shows the interface for 3D high-resolution forest map book including map title, map, legend, index map, scale bar and forest type and so on. Fig. 9 shows the result of performing e-mapping component in detail, especially in case of forest field.

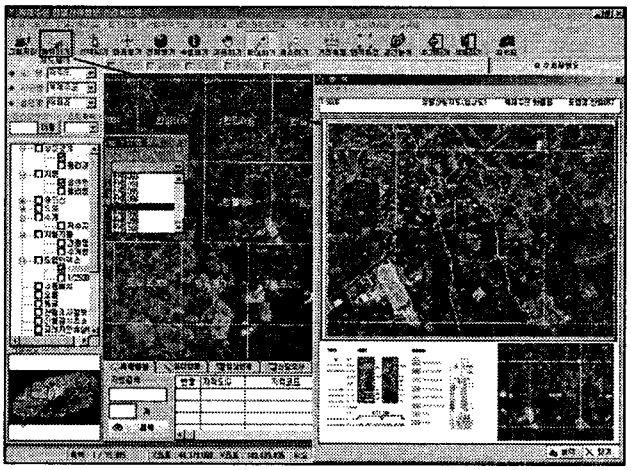

Fig. 8 System interface for e-mapping component

5. CONCLUSION

In this study e-mapping component was developed to possibly overlay with all kinds of thematic maps in various scales and provide the all detailed information by using high-resolution satellite image and GIS. Also, this system has powerful map composition tool to display map such as legend, scale bar, index map and so on.

In the near future, in order to increase GIS component reusability and interoperability in related domains, there should be the consideration for GIS component repository management system using not only metadata described here but also further extended metadata. Moreover, many GIS components, which can be operated and integrated in various system development environments, should be developed through the certain rule.

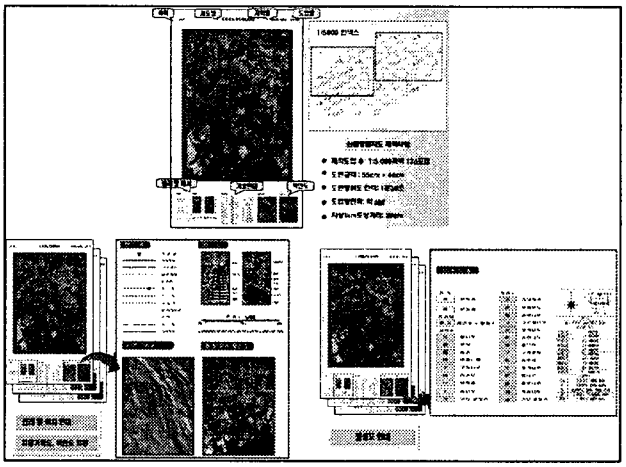

Fig. 9 Example of e-mapping component

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