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THE DESIGN OF URBAN UNDERGROUND PIPE LINE GIS BASED ON UML FLEXIBILITY SOFTWARE DEVELOPING MODEL

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ABSTACT:

Underground Pipe Line Systems are indispensable in urban construction   as there are various pipelines and these pipelines usually distribute in special environment, they need higher requests to management and maintenance. As so far, although there are many pipelines systems are used in many city, but these systems can't satisfy operation needs to pipeline management, and systems develop model is still resist on traditional software develop model. In this paper, we using UML flexibility software develop model to developed Yiwu underground pipeline system.

1.   INTRODUCTION

Urban underground pipeline systems are the important part of city, it including: communicate cable, light cable, tap water pipe, natural gas pipe, coal gas pipe and waste pipe and etc., these pipes are close to peoples life and city construction. With the development of the modern city, various establishments of underground pipes are increased and the quantity becomes larger. These pipelines appear complex and distribute in special geological location, they need higher requests to manage and maintenance. As so far, although there are many pipelines systems are used in many city, but these systems can't satisfy operation needs to pipeline management, and systems develop model is still resist on traditional software develop model. In such develop model, semantic diverge usually exist in system designer and user, and designer usually can't hold user requests, therefore, the designing efficiency is low. On the other hand, system design and test process cost too much, and the software products has fallibility, short life, low reuse, low compatibility, chaos documents, and etc. defects, its has no benefits to improve software quality and decrease maintenance fee. All in a ward, such a develop model is not suitable to complex and variable characteristic of city pipeline systems.

Aim at the characteristic of urban pipelines, and combine with the up to date GIS technology and theory and UML flexibility software develop model, we designed and developed Yiwu Pipeline Information System, in this paper, we try to introduce some of our core works.

2.   URBAN PIPELINE INFORMATION SYSTEM UML FLEXIBILITY DEVELOP MODEL

Urban pipeline information system (UPIS) is a complex software system, its include computer graphic and image process, complex spatial data describe, spatial database management, data compress and encrypt, web information transition and share, and etc. advance technologies (Li aiguang et al, 2001). As urban pipelines are very complex, UPIS has a larger framework and higher complexity, traditional software develop model is difficult to satisfy its development requests. Develop cycle of UPIS is no longer a process including requirement definition, software design, realize and deliver, it's should use iterative and increment develop model. In UPIS develop procession we use UML flexibility software develop model, The flexibility software developing model is composed by four part: Demand design, System Model, Result ,Code, each part has direct or indirect relationship with others (see fig.1).
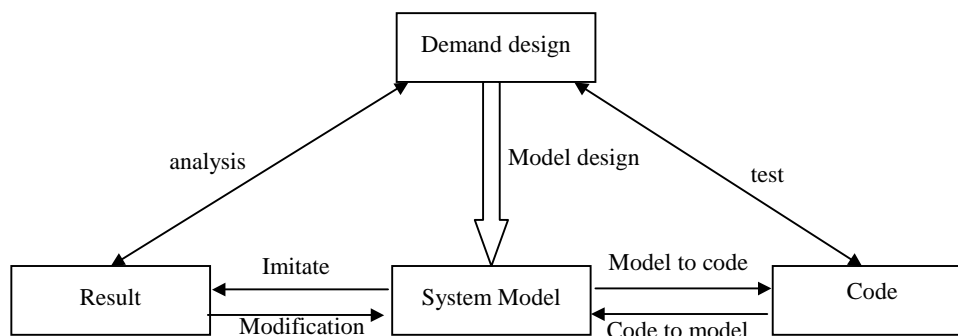

Figure 1. The flexibility software developing model

UML flexibility software develop model means in software develop process, considering actual engineering requirements, firstly establish UPIS top layer model, and simulate, analysis and adjust this top layer, then, divide the top layer model from top to down, and establish the model to each subsystem, and also simulate analysis and adjust these subsystems. Therefore, the whole modeling process is an iterative process from top to down and from down to top. In a ward, flexibility software develop process is modeling using division from top to down,and then use T style technology, through the virtual execute of the model, rework from down to top, until simulate result of each layers satisfy the requests.

The software code generation is based on correctness of the model, and also should consider flexible modification and rapid responsibility. That's it not only sustain automatic generation from model to code, convert new model to code, and also support converse convert from code to model. In this way, it not only could deliver the products in different period, and could also improve the responsibility and alterability, and so could satisfy user various and late needs (http://www.21cmm.com/uml/uml_zchj.htm).

3. ESTABLISHMENT OF UPIS FLEXIBILITY SOFTWARE DEVELOP MODEL

In the process from system engineering requirement analysis to system model establish, the perfect degree of requirement analysis directly decide the system quality. In UPIS software development, we use Rational Rose UML integration support environment (Jiang hui et al, 2001). Rational Rose establish the system develop environment under the requirement traction, its compose of UML visualization modeling system, simulate system, code generation system, converse convert system, quality control system and its support software, they all based on UML syntax rule and definition. (See fig.2)

Rational Rose is a 'close ring develop' and an integration support environment that could support system modeling, system simulate and system production. The establish process of urban pipeline operation model is: analysis urban pipeline operation content, establish urban pipeline operation management model, draw urban pipeline management legend diagram and operation flow diagram (see fig.3). Flow diagram is a special status diagram, describe required activities, orders of execute these activates and work flow. Its very important to system function modeling, its emphasis control flow between objects.
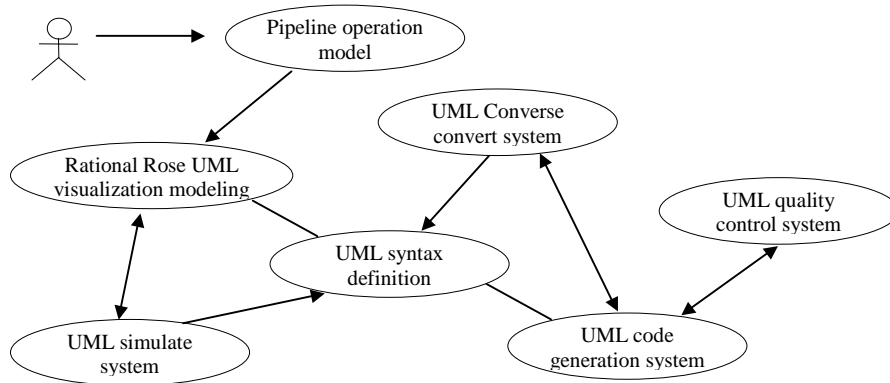

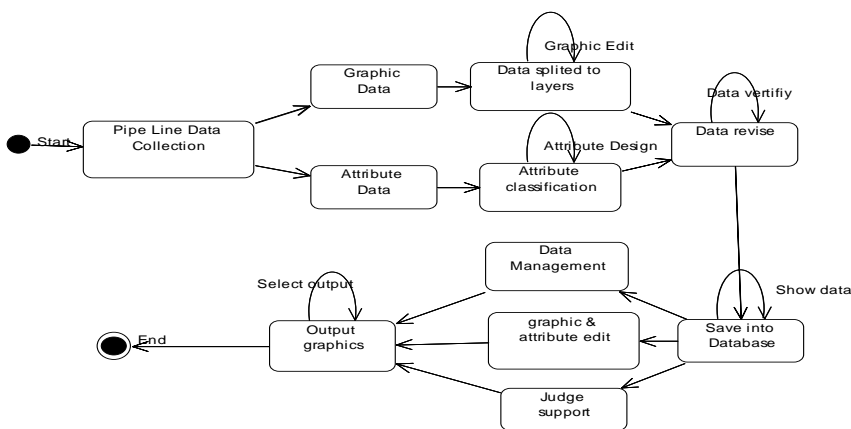Figure 2. Rational Rose used in UPIS internal modeling

Figure 3. The start diagram of pipeline management

4. URBAN PIPELINE INFORMATION SYSTEM SOFTWARE STRUCTURE

On the base of many time simulation and modification to UPIS software model, using Rational Rose produce model and generate core code. In develop process, the convert and converse convert between object model and software code are finished in Rational Rose. The system VB code is mainly generated by Rational Rose, besides MapX 4.0 is also used in software code generation and development. As UML using Object-Oriented technologies (Liu rengdong, 2001), in visualization modeling, visualization program environment, UML object class diagram and software code designed at same time, this way greatly improve the software develop and debug efficiency, and technology document could automatically generated from model definition. The main functions of UPIS are data management, graphics and attributes query and spatial analysis.

UPIS is composed of system function objects and database objects set, system function objects composed of theme cartography, graphic query index, statistic analysis, document manage object; database object is composed of graphic database, attribute database, professional database, document database (see fig.4).
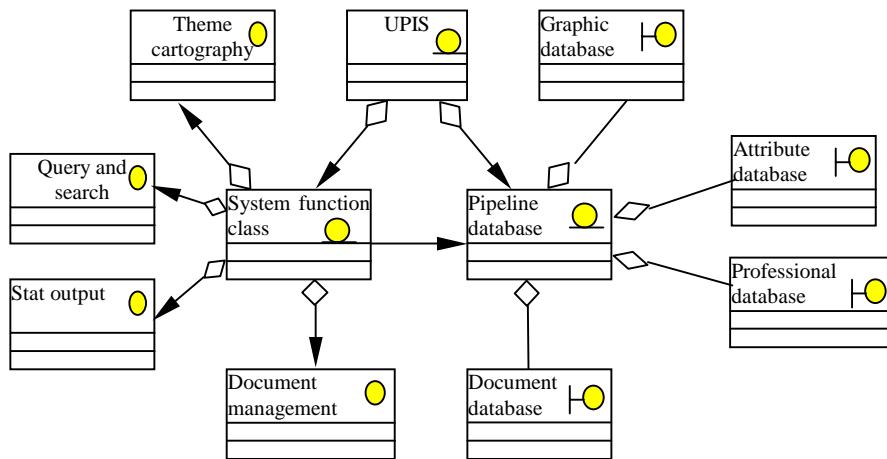
5. COLLABORATION DIAGRAM OF UPIS FLEXIBILITY DEVELOP MODEL

UML Collaboration diagram of UPIS flexibility develop model describe the interactive and links relationships between objects, collaboration diagram emphasis spatial relationships between objects, and reveals links and send-receive messages in group objects. It also emphasis the structure of send-receive messages, and modeling according the structure control flow. It display objects and links between objects and how the message send-received between objects, and it could be used to analysis the whole procession of UPIS utilization (see fig.5)

Common user logon in system, could review city graphic objects in scale of 1:250,000 and select and display objects in city area by the operation to city objects in such scale, user could get pipeline information through operation to these objects, the UPIS administrator could directly maintenance the all data.
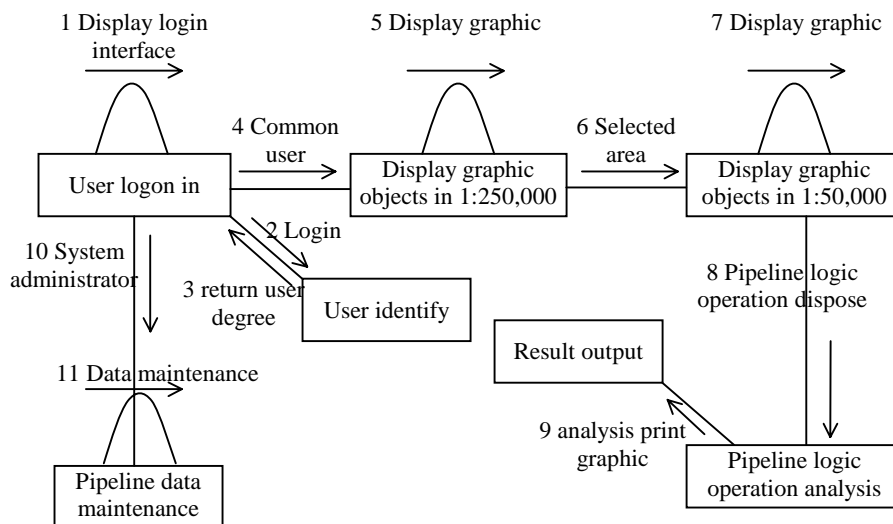
Figure 4. System structure of UPIS

Figure 5. Collaboration diagram of UPIS flexibility develop model

6. CODE FUNCTION DESIGN IN FLEXIBILITY SOFTWARE DEVELOP MODEL

Code function design in flexibility software develop model is mainly reflect the relationships between software model and software code (see fig.1). The main process is positive direction engineering and negative direction engineering. The positive direction engineering is produce software code from model, but negative direction engineering automatically modify software model by modify software code. The process is described by UML class diagram, UML class diagram display a group of class, interface and collaboration and their relationships. The class diagram illustrate the static design view of the system, it includes initiative class diagram, which focus on system static process view. The system might have several class diagram, signal class diagram only express one side of system. The higher layer shows the class function, the lower layer shows class attribute and operation. UML class diagram is the absolutely necessarily content to software designer in their communication, collaboration, and software integration and testing. UPIS is a theme GIS, the system store the high precision spatial data.

The main function of the system are: objects CP_GIS, user interface object UserGUI, data manage object DataManage, view manage object Viewer, Query object Query, system tool object SystemTool, database object MapDatabase, print object PrintTool, relationship of all object shows in fig.6.
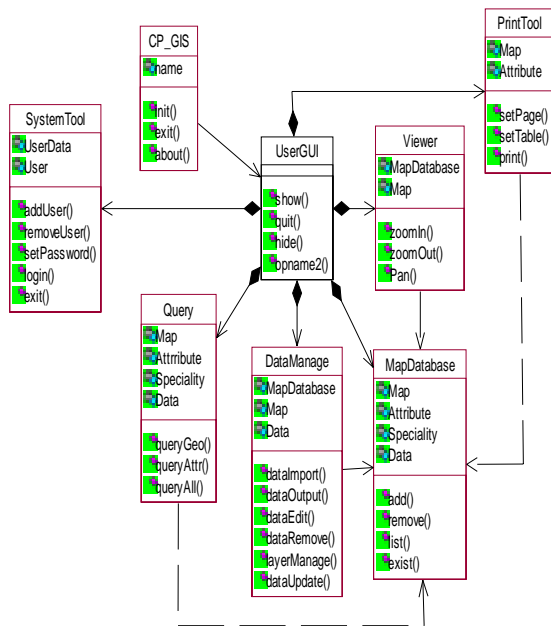

Figure 6. UML class diagram of the system function structure

DataManage object function is data input, output, modification and delete. Viewer object function is zoom in, zoom out and roam, query object function is query to graphic and attribute information, and also do search and statistic. System could query pipeline attribute information by its graphic information, and could do spatial analysis to pipeline, and also put forward historic document of pipeline, in addition the suggestion to pipeline maintenance and reference information to pipeline construction. The function of SystemTool object function is to configure data files, user login and user management and etc. The function of MapDatabase object is to manage map, attribute and professional database, it save system various document. PrintTool object serves for printing many statistic report forms, theme maps and pipeline document.

7. CONCLUSION

UPIS is complex system engineering, with the modern city construction development, pipeline types becomes more and more, different pipeline manage different logic operation, UPIS software system must extend newly increased operation models in at any moment. During the UPIS system development, as we using UML flexibility software develop model and Rational rose UML integration develop platform, semantic expression could keep consistent between user and system developer; and system realize cycle testing between model and code, software reusability is higher, and documents have unify standard. In actual using, system is running with higher credibility, and greatly improves pipeline system management efficiency.

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