Design and Implementation of Graphic Editor in Electrical Automation Monitoring System

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ABSTRACT: *In this paper, the requirements of the graphic editor in the electrical automation monitoring system are analyzed in detail. The electrical automation monitoring system requirements, and puts forward the key technology of software architecture based on. Net platform and MVC design pattern to design and develop the technical scheme and the graphics editor, and to the local refresh, editor of graphic management and chart module integration as the center, in accordance with the system view layer, control layer and model layer order completed the detailed design of the function of each layer of the core, put forward a clear structure, has the good but expansibility, maintainability and reference value of power graphics editing system model. On the basis of demand analysis and the detailed design, the realization of the main view fast refresh, mouse on the graphic visualization operation, through drawing fill library, drawing selecting database, draw a diagram of key function and model retrieval, document management auxiliary function. The realization of graphics system is able to provide a good graphical user interface, the user can conveniently wiring diagram of power system network drawing and modification on the graphics for the hierarchical management user can according to site requirements of the primitive equipment custom used in drawing on the wiring diagram, as long as through mouse operation, can complete the power system calculation parameters input and equipment elements of primitive modeling parameters stored in a database, the database has a good generality and contains the electric power system analysis and calculation of the required information.*

1. Introduction

The process monitor screen has been made as a traditional analog dashboard; operators do not have time to check the instrument data on the arrangement of the dashboard, and only need to easily sit in front of the display, where they can watch

the whole process of the work, also can realize the operation of equipment through a computer monitor system in the current monitoring system of power plant. Now standard electrical automation software provides a graphical editor, the engineering and technical personnel can use the editor by easily drawing the monitor screen, and realize the function of data display and remote operation. Therefore, as the system function is the most intuitive and vividly expressed, the system show the end user operation platform, graphics creating, editing and display fully which embodies the advanced nature of the system, ease of use, and use humanized design concept (see figure 1 and 2).

Figure 1. Electrification monitoring applications

Figure 2. Machinery electrical control system (Chinese version)

In this paper, the graph editor is a non-real time online sub module used for electrical automation monitoring system, which is responsible for the creation and editing of power equipment model, wiring diagram[1], data diagram and other resources. Currently used to draw power system wiring diagram of the graphical tools, the common relationship between the following graphics and database processing has not found a good solution, or graphics; and there is no contact between the database used to calculate or not closely linked and mutual communication is thus difficult. Most of the graphics are relatively independent, graphics editing is complex and inconvenient to modify. Graphics storage mostly adopts the method of file or two-

not reflect the change of the component state in real time. The intelligent level of the graphic analysis is not high, the power network topology is generally used by manual input, and there is no direction of the network topology, and the system has state to distinguish the analysis. Many scholars introduced the computer graphics into the power system analysis software, but basically for a system analysis to function and work, the majority of the realization of optimal power flow, the short circuit calculation and other single function, graphics and model reasoning need not be associated. Therefore, how to design a convenient power system modeling method to meet the requirements of the developers and users of power system modeling has become the main problems faced by the current graphics editing system.

2. Related technology analysis

MVC began to exist in desktop applications, *M* refers to the business model, *V* refers to a user interface, C is the controller, and the use of MVC is the realization of *M* and *V* code separation, so that a program can use different forms of expression. For example, a number of statistical data can be used to represent histogram, and pie chart. The purpose of *C* is to ensure that in the *M* and *V* synchronization, once the *M* changes, *V* should be synchronized with the update. Model view controller (MVC) is a kind of software design pattern, which was invented by PARC Smalltalk in 1980s, and has been widely used in programming language Xerox 80. Later it was recommended for Oracle's Sun Java EE platform design model, and is more and more popular with the use of ColdFusion and PHP developers who welcome. 'Model view controller' model is a useful tool kit, and it has many advantages; but there are some disadvantages. The Framework, design patterns are always easy to confuse the two concepts, in fact, there is still a difference between them. The Framework is usually code reuse, and design patterns are design reuse, architecture is somewhere between the two, part of the code reuse, design reuse, sometimes analysis can be reused. There are three levels of reuse in software production: internal reuse [2], namely in the same application can use public abstract block; code reuse is general module combination into library or tool set to in a number of applications and fields can be used; application framework reuse is special fields to provide general or the existing infrastructure, in order to obtain the highest level of reusability. Although the framework and design patterns are similar, but they are fundamentally different. Design pattern is the description of the problems appear repeatedly in certain circumstances, and the scheme exists to solve the problem of it than the framework more abstract; framework can be expressed in code, can be performed directly, or reuse, and to model only instances to code said. The design pattern has smaller frame elements and a frame often contains one or more design patterns frame always for a particular application area, but the same pattern can be suitable for a variety of applications. It can be said that the framework is the software, and the design model is the knowledge of software (see figure 3).
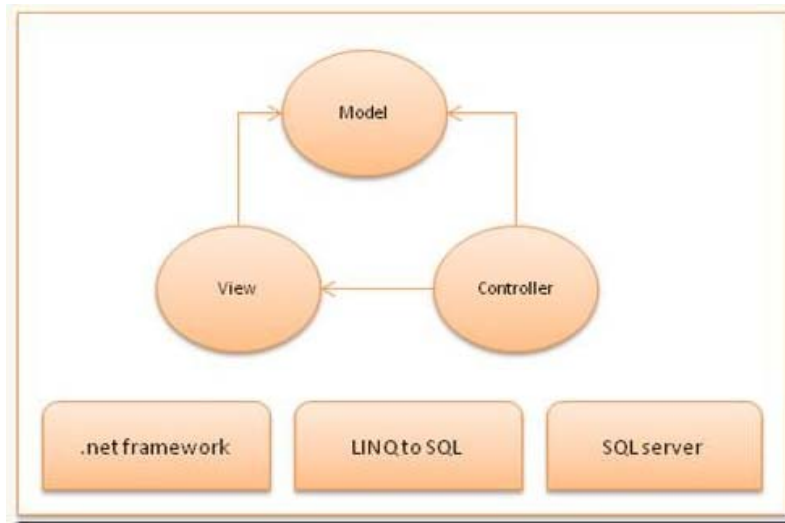

Figure 3. Schematic diagram of MVC architecture

2.1 Object oriented design idea
Object oriented programming is in the real world description object methods to describe the software problem, it is the decomposition of a complex thing for one relatively independent of "object". The "object" as a system in the basic running entity, and "object" is in the package. The description of the object of special properties and methods, between the various

objects although they are independent of each other but through message interaction, make whole program by a variety of different types of objects are grouped together to complete the function. Object oriented programming is not only a leap in the process of programming, it also brings us a lot of benefits. First, the code reusability is greatly improved, so that the programmer is to get rid of the repetitive work, and second is the extension of the code. A system, is considered as a relatively large system. During the early period of development, it was difficult to predict the future development. Therefore, at the beginning of the data structure, the program structure often meet future needs of the system. If the system is more difficult to modify, even related to the structure of the entire system, has a lot of work. In this way [3], the workload is much smaller than that of the object-oriented programming method. Because a complex object is divided into a number of relatively independent objects, the object of the connection between the information needs to be transmitted. Once you need to modify, as long as the process of changing the pattern of accumulation, and each function block is not changed, thus greatly reduces the modified workload(see figure 4).
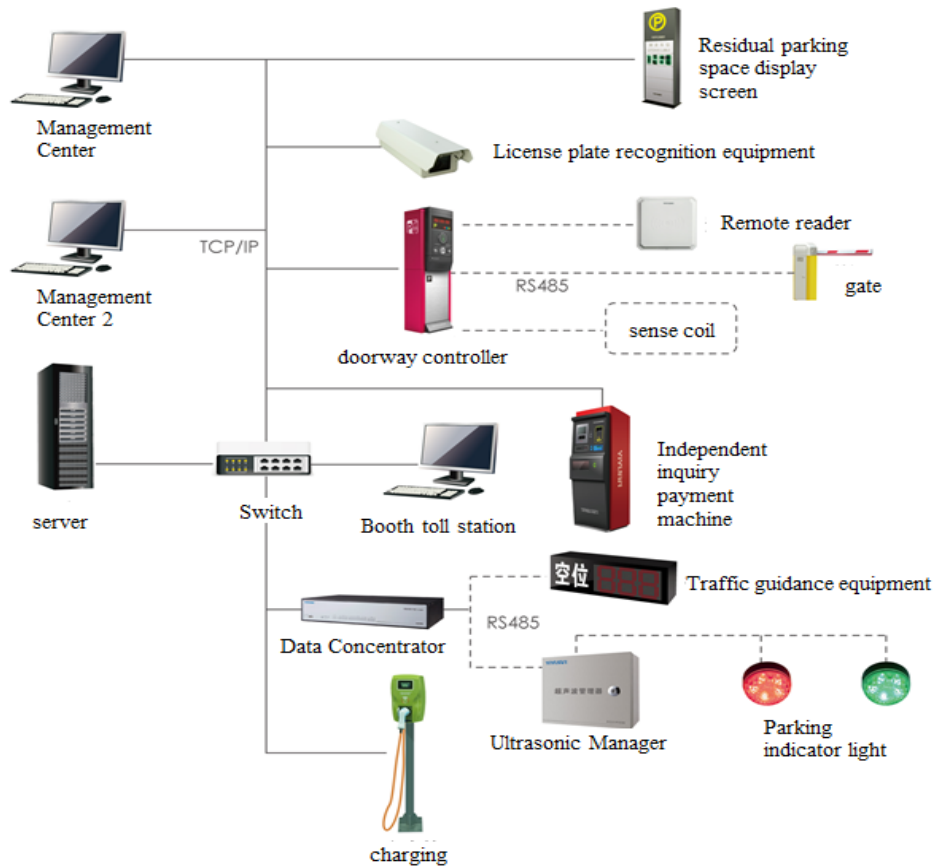

Figure 4. Schematic diagram of system structure

2.2 Struts2

Struts2 is a Web application framework based on MVC design mode, which is essentially equivalent to a servlet, in the MVC design pattern, and the Struts2 as the controller (Controller) works to establish the model and the view of the data interaction. Struts 2 the next generation of Struts products, is a combination of the new Struts 2 framework based on the struts 1 and WebWork technology. Its new Struts 2 architecture and has a big difference with the Struts 1 system structure. Struts 2 with webwork as the core, the interceptor mechanism in it will deal with the user's request. This design also makes business logic controller and can with servletapi complete off; so the struts 2 can be understood as webwork of updated products. Although from Struts 1 to Struts 2 has a very big change, but with relative to the WebWork, the Struts 2 change is very small. After more than six years of development [4], Struts1 has become a highly mature framework, whether its stability or reliability has been widely proved or not. The Market share is more than 20%, with a wealth of development population, and it has almost become a fact of industrial standards. But with the passage of time and the progress of technology, the limitations of Struts1 are also increasingly exposed, which restricted the continued development of Struts1. For the Struts1 framework, due to the tight JSP/Servlet coupling, it led to some serious problems. First, Struts1 supports a single presentation layer technology. Due to the

emergence of the era of Struts1 earlier, at that time there was no FreeMarker, Velocity and other technologies, so it is not possible with the template technology to integrate the view layer. Secondly, the serious coupling between Struts1 and API Servlet makes the application difficult to test. Finally, the Struts1 code is heavily dependent on the API Struts1, which belongs to the intrusive framework.

2.3 Requirement analysis

In this paper, the development of graphic editing tools to ECS (electric automation control system) system and the system unified electric automation control integration platform based on using hierarchical modular and components design idea, is studied and it is found to have high reliability, scalability, ease of maintenance and open. Through a variety of means of communication for convenient access to the different manufacturers of protection and control device and the user's existing automation device, it can realize a plant with comprehensive functions of electricity in the low-voltage electrical system protection, measurement, control and analysis. At the same time, DCS, SIS and other systems would provide the external data interface, and a more rich electrical testing data, to achieve the resources between different systems or data. This requires that the system provides a friendly support for the establishment of original data input, model, thus greatly reduces the difficulty and workload of the original data input, and the system with the input data detection tool, greatly improve the accuracy of data entry. So the graphics editor needs to achieve the following functions (see figure 5 and 6).

Figure 5. Electrical automation control equipment

Figure 6. Electrical automation control equipment (b)

3. Design and implementation of a wiring diagram drawing

For graphics systems, the most basic and most important function is to draw and edit the different types of power system components. The data and function are combined into one unit by using object-oriented method, and the specific design for each element is defined by a class. Each element has own a variety of attributes and data, such as size, shape, position, etc., also have their own behavior, such as drawing, move, rotate, copy, delete and other. Using the object oriented technology, the data and operations are encapsulated together, to realize the graphic system of the respective functions and operations. At the same time, all kinds of elements in addition to their own special properties and behavior, there are some common places, such as color, brush width, etc. So we can use class inheritance and derived characteristics, the establishment of various elements of the public abstract base class and other elements based on the derived, which greatly reduce the amount of programming. It not only eliminates the redundant code, but also enhances the readability of the program. The graph element is mainly used for the definition of the shape of the device element in different state, at the same time, it can be directly connected to the graph element without the need of topological analysis [5].

4. Conclusion

This paper according to the mode of the MVC system from three aspects, that is, the view layer, control layer, model layer of the detailed design, make the wiring diagram drawing process as an example. From the primitives are defined, layers are drawn to display and graphic visualization operation management. Three important aspects of design and implementation are used to achieve the production of flexible and convenient editing circuit wiring diagram. The primitives are defined for the common primitives, icons, graphics and equipment elements. The primitive data classification and the relationship between design and analysis, through the node design as well as the corresponding database data for the circuit topology analysis lay the foundation layer. The circuit topology drawn through the block can improve the image display fluency and graphic visualization operation management. Through the control block of the setting and operation design and graphic distortion, the variation to explore and summarize, combined with primitives are defined and canvas rendering primitives are used without distortion editorial changes. Thus, a graphic editing system can be customized, which is flexible and modify graphics, and can generate the topology wiring diagram, where the corresponding model can be realized.

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