A GIS-based Power Transmission Management Information System

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***Abstract*—Based on analyzing the shortcomings of electric power enterprise in traditional operation pattern, this paper combines components GIS with the application of management information system, and uses the structure which unifies three layers C/S and B/S. Also, proposed using the GPS intellectualization patrol. This may be useful to guarantees the transmission line's operation to be safe and stable.**

Keywords—***management information system; components GIS; intellectualization patrol.***

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1 Introduction

In the traditional high-pressured electric transmission operation management, using the blueprint and the form material filing-up preserves the pattern [1], but the transmission line but the transformer substation blueprint material are numerous and diverse, the quantity is big, it is difficult to store, also the line changes the route, the pole tower's fluctuation frequently and so on which all requests the blueprint to change as necessary. When the pole tower breaks down, the attendant only depends on the memory to rush to the breakdown tower pole, easy to delay the emergency repair time which can create the economic loss and bad society affects. The application of GIS technology will effectively solve these weak links in traditional patterns and can obtain considerable economic efficiency and social efficiency [2].

GIS may organize the spatial information and attribute information which involves the line organically and provide the user inquiry, browsing, statistics and so on [2]. This article in the deep understanding traditional high pressure electric transmission administrative mode's foundation, Using module type GIS technological innovation management and combining with the high pressure electric transmission management's present situation raises the optimization the system architecture. This system takes Arc GIS as development platform, selects the nimble C# language, and unifies the SqlServer2005 database technology develop high pressure electric transmission management information system [3, 4].

2 GIS platform

2.1 The GIS platform introduces

The Geographic Information System is the fusion of geography, geometry, the computer science and each kind of application object as one comprehensive high technology and new technology [5]. Through unifies each kind of information in social life and chart shape information which reflect geographical position closely in together, and analyze the information according to user needs. Then the policy-making and reference will according to these results, which can expressed the processing result by the map, the chart shape or the data form, enhanced the scientific management and rationalization of user.

2.2 GIS platform choice

The GIS system may take graphics support system of the electric power's application system. in the electric transmission GIS system, classified according to the data origin, may be divided into the geography background data and the electrical network data. The two kinds of data both are very important, the electronic map's, not only as the geography background chart, the more important is use it to carry on the related analysis and the statistics. In order to serve this purpose, this system uses module type GIS.

Compared with the traditional GIS, the Module type GIS have these merits [6]:

1) Exquisite nimble, the price is cheap: The module type GIS platform provides the capacity of the spatial data's management intensively, and can connect to the database system by the nimble way. Under the premise of guarantee function, the system displays exquisitely nimbly, but its price is only 1/10 of the traditional GIS development kit, even are less.

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Thus, the user then can obtain or develop the GIS application system by the good performance price ratio.

2)Does not need the GIS development language specially, inserts the MIS development kit directly: The module type GIS established above the strict standard, it does not need the extra GIS re-development languages, only needs realize the basic function functions of GIS and develop interface according to the standard of Microsoft ActiveX. This is advantageous in lightening the burden of the GIS software exploiter, moreover strengthened the GIS software's extendibility. This is an idioplasm leap compared with the traditional GIS technicality development environment.

3)Formidable GIS function: The new GIS module is based on 32 system platforms, uses the InProc direct transfer form, therefore ,regardless of the ability of manages the big data or the processing speed aspect is not more inferior than the traditional GIS software. The small GIS module can definitely provide spatial processing abilities as splicing, cutting out, superposition, buffer and the rich spatial inquiry and analysis ability and so on.

Develops simple and direct. The GIS module can be inserted into the MIS development kit directly and the general development personnel may select their own familiar development kit freely. Moreover, the GIS module provides the form of API which close to MIS tool's pattern, the development personnel may manage spatial data as map skilled likely to manage the database table, does not need special training.

Therefore, this system GIS software platform uses American ESRI Corporation's module type Arc GIS, uses the Arc SDE spatial data engine in the server end, takes SDE and the relational database as the database administration service software, manage the graphic data and attribute data centralized. In the client side, using the Arc0bjects module and Visual Studio 2005 develops the application system. The application system visits on the server using the C API in Arc SDE client side and the Arc0bjects transfer the database which managed by SDE Server. Arc SDE unifies the spatial data and the attribute data in the commercial database, has guaranteed security and openness of the GIS resources. Also Arc SDE has used the advanced spatial index technology and supports the mass data depositing and the massive user's concurrent visit, has the extremely high performance.

3 System structure

Some electric transmission management information system's structure appeared in Domestic and foreign divides into the C/S structure and the B/S structure, by C/S structure majority, but the C/S structure mostly stresses in the data input and the auxiliary management of routine work, has neglected the conformity to each kind of data as well as the refinement and the analysis, cannot display the computer network as well as the formidable information-handling capacity of database's technology truly, cannot service in production management fully. The partial power transformer management information system which uses the C/S structure hasn't the synthesized inquiry analysis function, cannot process the relations of dispersion and the centralism of information resource fully. In fact, should request and standard the construction of various data pools using the synthesized inquiry analysis system, enrich the data pool, enhances the function of synthesized inquiry analysis system, does for the supplement, promotes mutually.

Along with the rapid development of Internet technology, Browser/Server structure, another kind of information management system solution obtained the application and the development. It may simplify the installment and the disposition in the client side and reduce the cost in software development and reduce attendant's work load mostly. Moreover the B/S structure has the superiority in cross platform, the artistry in contact surface's designation, the ease of operation, as if is one kind of very good solution in the information management system [7]. But, in the electric power production, the scale of electric transmission network is huge and the service is complex. The B/S structure was inferior to the C/S structure by far actually in convenience and quick in the realization of complex data analysis the data maintenance.

Both them have the advantages respectively. Consider of the characteristic in electric power profession itself: The electric transmission network scale is huge and it's business are many and complex, both needs to realize the complex data processing and the data maintenance and needs to provide the function of convenient and quick inquiry facing the massive user, this system uses structure[8] which unified three C/S and B/S, uses the B/S pattern facing the massive user's data inquiry and the statistical function as well as simple service logic, but uses the C/S pattern facing the complex data maintenance and the data analysis, this is without doubt one kind of very good solution in the information management system.

Therefore, the information technology of electric power enterprise is developing to the direction which unifies the C/S based on GIS and the B/S pattern. This will realize the centralized management of electric power production conveniently and establish the unified standard system, will enhance the operating

efficiency of enterprise greatly, will provide the safeguard for enterprise's safe and stable movement. System architecture as shown in Fig 1:

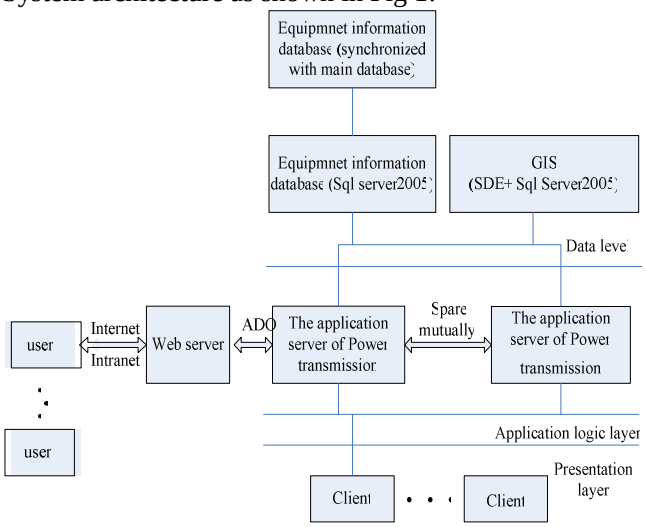

Figure1. The Structure Drawing of System

For using database resources fully, ensuring the system safe and reliable, two servers are compounded the main database and the spare database separately, the host, they use the data access synchronization so the performance lose few. When the main database appears the breakdown, the spare database may operate fast. The database of application servers has also adopted the strategy which using two servers database service mutually for the spare, it's interaction is strong, the speed of data inquiry and the revision quite is all quick. Moreover the Internet users and the local area network users all are visit the database server through the application procedure servers, Therefore, controlling the visit jurisdiction in the application procedure server end may guarantee the relative security of the Electrical Power Office's database which also can ensure the system's movement safe and stable.

4 The introduction of system function

The electric transmission management information system includes six modules: the system establishment, the power transmission network resource management, the patrols management, the flaw management, the movement management and the overhauls management. This system uses the advanced GPS to patrol the transmission line mobile and realizes the intellectualization to patrol the management. It will download the duty of patrol to GPS automatically and upload the results to the database, which will be advantageous for determined which lines are perfect which lines have the flaw to need to service. Thus the related person formulate service plan and report the higher authority department for authorization simultaneously and receives the materials needed from the commodity company and further implements which will guarantee the transmission line operation normally The system function structure, following shown in Fig2:

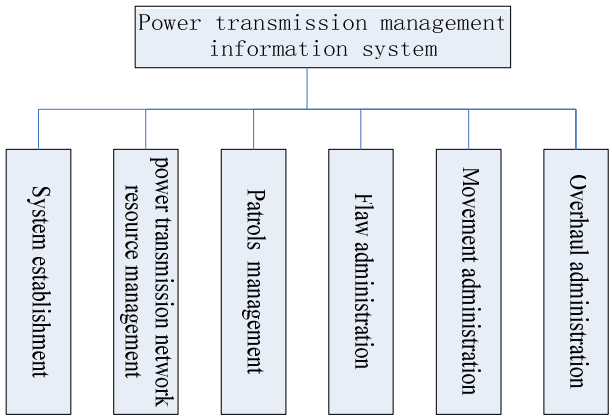

Figure2. The Structure Drawing of System function

4.1

The system establishment module includes: Jurisdiction establishment, the introduction of transmission line, Serial port establishment.

Jurisdiction establishment: It has established each department as well as staff's jurisdiction, and may increase or delete some department or staff's jurisdiction conveniently. And has demonstrated them in the jurisdiction tabulation which is advantageous for the change and the inquiry.

The introduction of transmission line: Lists the lines this system includes by directory tree's form in the left side. When click the random line, it can list the line detailed information in the right side by tabulation, which facilitates the inquiry.

Serial port establishment: establish connection with other system module.

4.2

When click the power transmission network resource management module you enters the GIS electric transmission edition interface .It introduces the GIS map in this system-wide and the background map by the direct-viewing impression .You can examine the correlation line and its attribute as well as the pole tower information on the map, direct-viewing saw will appear the jurisdiction the place, by will facilitate the deployment to overhaul and to service the operation plan. See the place which lacks presents Direct-viewing, which is facilitate for deploying the operation plan of overhaul and service.

4.3

The patrols administration module includes: the basic information management, the patrols duty edition, the data communication, the data of patrols management, the inquiry statistics.

The patrol management use the GPS patrolling mobile, realize mainly by data acquisition of the palm on the computer and the backstage management system management system. On palm computer built-in satellite positioning module, which can be used to manage the acquisition of each kind of information at patrol scene, and may input integrated flaws of equipment and the ambient conditions along the route written by hand .The backstage management system carries on the data processing and realizes the management of intellectualization patrol and provides the real-time data for the overhaul management, the flaw management, the movement manages as well as inquires

Through the formidable inquiry and the report form function, this management system reflects the current equipment condition comprehensively and promptly, and grasps equipment running statuses through the function of multi-spot comparison and data tendency and so on, which can prevent “outs the service” and “owes the service”, reduces the breakdown formation rate of the line and reduces maintenance expense of the line greatly. The intellectual transmission line patrols not only can record the arriving situation of personnel when patrolling accurately and completely, but also realize the paperless, the entire journey online controllable management on the entire patrolling work of equipment.

1)Basic information management: including the management of department staffs, the flaw rank management, the management of patrol’s pattern, the pole tower management of line.

It mainly manages each kind of patterns of the patrol and the flaw rank and may increase or delete the existing patterns of patrol according to the actual situation, also may carry on edits and preserves, also may cancel the operation which does (before preservation).

2)Patrols the duty editing: Mainly formulates the plan (content) of patrol according to the actual situation.

3)Data communication: which downloads the concrete content of patrol’s plan to GPS and uploads the result of GPS patrol’s to the computer on file.

4)The data management of patrol: Including the input, cleaning up and backup of data. It mainly manages the inquiry and statistical function of patrol’s results.

5)Inquiry statistics: Including arriving inquiry and omission statistics .The former inquires whether the staff patrol to the place which assigns in the time which assigns .The omission inquiry is to inquire the equipment which be discovered has flaws and should be repaired Whether to omit the equipment which should service.

4.4

The flaw administration module includes: the flaw management, the flaw classification statistics and the flaw elimination statistics.

1)The flaw management: Including the flaw rank, the flaw input, the flaw verification, the defects elimination.

2)The flaw classification statistics: which including the line flaw and the pole tower flaw, or be divided into the general flaw, the significant flaw and the urgent flaw according to the flaw rank. It is mainly compiling and reporting to overhaul company the flaw and its processing situation which discovered in a period of time (a week, a month or a quarter), also which is advantageous for the inquiry.

3)The flaw elimination statistics: Which including the flaw has not eliminated, already eliminated and the statistics of flaw eliminates.

4.5

The movement administration module mainly manages the movement and the maintenance of line: Including the examination of insulator's salty density, the examination of zero value insulator, the earth resistance’s survey, the pole tower’s incline survey, the management of hidden corridor danger, the inspection of the back guy stick’s excavates, the attachment temperature’s inspection, the inspection of overlapping spanning, the line power frequency parameter’s survey, the survey of lead’s sagging and the movement of electric cable.

4.6

The overhaul administration module includes: The management of overhaul plan, the overhaul’s record management, live-wire work recording.

1)The management of overhaul plan: Mainly manage plan’s (yearly overhaul plan, monthly overhaul plan, spring examine plan) formulation, revision and deletion, and also manages the plan’s deriving and examination.

2)The overhaul’s record management: Mainly is to manage the addition, the export, the examination, the revision, the deletes and the inquiry of overhaul’s records as well as manage the maintenance record’s flow operation.

3)Live-wire work recording: Mainly is to manage the input, the revision, the deletion, inquires as well as derives and the examination of the live-wire work’s records in the overhaul’s construction process, and also include the flow operation of live-wire work recording.

(Continued on P.10)

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(From P.4)

5 Conclusions

Along with the electric power organizational reform unceasingly thorough, the tendency of the transmission line management and the MIS‘s fusion and integration is more and more obvious, based onthe safety control characteristics of the electric power profession, MIS will be displayed its key role in the business management fully. Realizing the effective integration of specialized management of safety in production and the business management will be the advanced pattern of electric power information oriented great-leap-forward development. Moreover the electric transmission management information system based on GIS has these merits: the automation is high, the reliability is high, the data will renew quickly, the information content will be big which is advantageous to the resource’s optimized disposition, Therefore it will have the widespread application prospect in the electric transmission management.

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