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The Research in Remote and Real-time Monitoring System of Digitized Earthquake Omen Instrument

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Abstract. Based on the monitoring system of the earthquake omen instrument in the ninth five-year plan and the tenth five-year plan, this paper mainly remarks the overall structure, function modules and interfaces in remote and real-time monitoring system of digitized earthquake omen instrument. By the earthquake private network, we can establish the multiplex of real-time monitoring services among the center of national seismic network, the center of region seismic network and the seismic station.

Keywords: The earthquake omen instrument; remote and real-time monitoring; earthquake private network; Seismic network

1. Introduction

China is a country of earthquake disaster frequently, the earthquake forecast not only is the China Seismological Bureau's duty, but it is also the very important research content, this research needs the massive geophysics observed data. Therefore the China Seismological Bureau in the country has established many earthquake stations for observations and collect information on earthquakes and used the observation data for the study of earthquake prediction [1].Omen information is high practical value in the medium and long-term earthquake prediction and the Short-term earthquake prediction, using the omen information to earthquake prediction is current seismic analysis and forecast the direction of the main experts [2].

Nonetheless, due to the earthquake in China is very frequent recently, especially the 2008 Wenchuan earthquake and the 2010 yushu earthquake, that gives us loss of resources. The timely request which forecast to the earthquake is getting higher and higher [3].It is necessary for us to use the domestic and international advanced technology to achieve accurate prediction of earthquake. During the past 10 years, the Internet is the representative of the network technology, and the networked devices which in close connection with computer technology become the master of the development of a measuring instrument. We need to carry on the real-time remote monitoring which is based on the Internet technology to the earthquake omen instrument. From all over the station remote monitoring centre, to the regional network center monitoring, ultimately to national network remote monitoring centre, we can realize the precursor instrument remote real-time monitoring.

This paper mainly remarks the overall structure, function modules and software interfaces in remote and real-time monitoring system of digitized earthquake omen instrument by the earthquake private network. The monitoring system has implemented of three features, that is, real-time status monitoring, real-time waveform monitor and process status monitoring. We can carry on the equipment real-time monitoring among the center of national seismic network, the center of region seismic network and the Seismic station, gather more comprehensive and accurate data, and provide the even more real-time earthquake omen instrument's monitor for the staff, all these will give the earthquake prediction to provide the enormous convenience[4].

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2. The Overall Structure of Remote and Real-time Monitoring System of Earthquake Omen Instrument

2.1 The guiding principle of monitoring system

The guiding principle of remote and real-time monitoring system of earthquake omen instrument is the development of a medium-and long-term planning, which is directly in order to enhance the seismic monitoring quality of service. Its guiding principle is:

*1) Face the overall:*Facing global requirements need us view problem from a holistic point. The national seismic monitoring system should be a whole, we designed remote and real-time monitoring system of earthquake omen instrument should be geared to the needs of a global, from the overall needs of the target service as a whole,so the system design should take into account the external environment.

2) Facing the future: Facing the future require us to design system from the long-term development perspective, it is the long-term decision-making to the remote and real-time monitoring system of earthquake omen instrument. So we designed remote and real-time monitoring system of earthquake omen instrument should be consider two hands: on the one hand must consider the seismic surveillance system's improvement, the development and the expansion, cause the overall concept with its to match;on the other hand must consider that the trend of networking development, considered possibly appears and has appeared the new product, the new theory and the new method in order to enhance the advancement of the remote and real-time monitoring system of earthquake omen instrument.

3) Full use of existing resources: In order to reduce investment and the development cycle, generates benefits as soon as possible, based on the overall objective which is the remote and real-time monitoring system of earthquake omen instrument, we must to consider the integration requirements of the system platform, make full use of the existing system of your computer, equipment, technical personnel, materials and other resources to enable it to play a role.

2.2 The overall of system construction

The remote and real-time monitoring system of earthquake omen instrument is based on past seismic network application software, in conjunction with the tenth five-years plans about Digital seismic observation network project of relation tasks for the development of professional software [5].The application scope of overall system including the center of national Seismic network, the center of region Seismic network and the seismic station. The center of national seismic network and the center of region seismic network mainly on the data processing; the seismic stations is a data source and the data acquisition units. The overall structure of the monitor system is shown in figure 1:

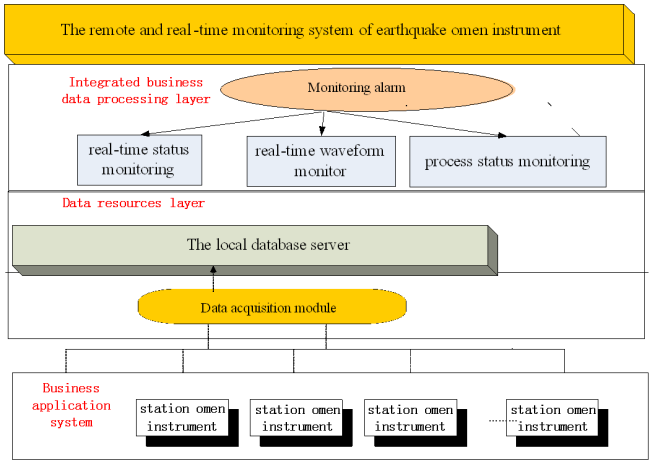

Figure.1. The overall structure of the remote and real-time monitoring system of earthquake omen instrument

2.3 The architecture of system

In the choice of the architecture of the remote and real-time monitoring system, we use the complete works of mode, which we can try the system improvements and upgrades easier, but if we uses the distributional works of mode, we must require upgrade each branch office system when we modify the system. In summary, the system is confined to three-layer architecture design patterns. Because all of the data storage and data processing centers are concentrated in the system, the benefits of concentration are the data

management focus, data management focus and disaster backup and investment protection easily. By the client to access and manipulate, we has used the web applications c / s architecture, the subsystem design is based on Struts framework. Three-layer architecture is shown below:

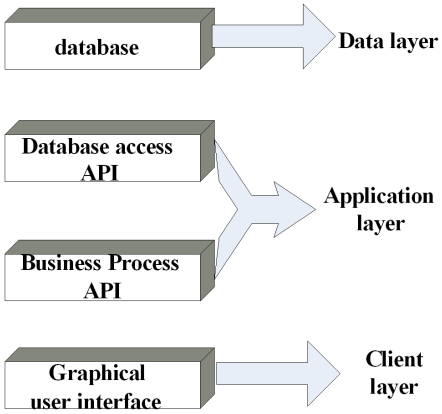

Figure.2. Three-layer architecture of the remote and real-time monitoring system of earthquake omen instrument

With the continuous development of distributed technology, three-layer structure established mature, it is an application of distributed technology. The basic idea of three-layer structure is based on distributed technology, it has used the components technology, divided the information system into three functions, that is, logic (client layer),business logic (application layer) and data management (data layer) three blocks, they were placed in the same or different hardware platforms.

Firstly, the client layer is the user interface part, that is, human-machine interface, it is the interaction between user and system information window. The main function is to guide the operator to use interface, input data and output results. It does not have business logic, or just have some secrets do not involve core application logic.

Secondly, the application layer is the main of the information systems, including business logic of systems and variable core. Its function is to receive input, processing the results returned. Standardized application layer development tools, can achieve the unity of variety of application structures; by modular design, it can achieve high availability applications. Application layer implements the separation of business logic and presentation logic; make the system the flexibility to adapt to changes in business logic users.

Finally, the data layer is based on large databases SQL SERVER database management system, it is responsible for Management and maintenance of the database to read and write, can quickly perform a large number of data updates and retrieval. Data layer has achieved centralized data storage and ensured the ability of data consistency.

In the three-layer architecture, the client layer can not directly access the data layer; it can only through application layer to connect the database, to complete business process. The main advantages of this structure is as follows: on the one hand, it use of thin client / fat server architecture, that is put business logic on application layer, business logic changes only in the application layer, and the client layer only deals with the information input, the results of the display and control of business processes. This makes the whole system better scalability and maintainability; on the other hand, it increases the system performance of network security. In the three-layer architecture system, the attendants on duty only through the application of the data in the database for retrieval and use, can not directly access database server. Therefore, it not only avoids the destruction of the database system, but also avoids the possibility of hacking the database server to ensure data security.

3. The Function Module Designing of Monitoring System

The function structure of the monitor system is shown in figure 3:

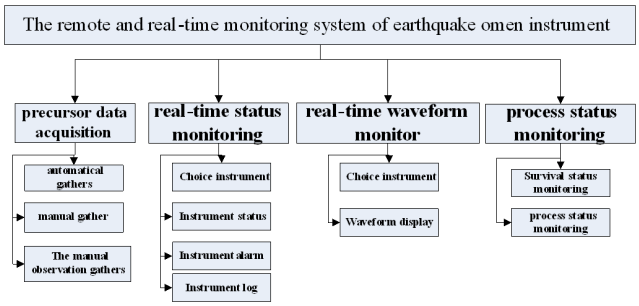

Figure.3. The function structure of the remote and real-time monitoring system of earthquake omen instrument

3.1 Precursor data acquisition

The system has used the instruments of the ninth five-year plan and the ten five-year plan. Observation data acquisition module has implied precursor instrument of data acquisition based on two communication protocol, that is, data transmission is based on the RS232 port and the TCP/IP protocol. Data acquisition services use the distributed server deployments; it receives consecutive waveform data of the adapter output instrument and other data acquisition of the real-time waveform data. It can realize data collection and Exchange, with reusable, on-demand, VOD and can record clear log records, provide complete management function.

3.2 Real-time status monitoring

This module is divided into four parts, that is, choice instrument, instrument status, instrument alarm and instrument log, it is responsible for monitoring and control functions of device, providing the fully valid device command for device control structures, sending real-time structured device command and matching the results of the Data acquisition package. We have used the cache mechanism and timing in the device status monitoring module. The module supports concurrent visit from the homepage, uses UUID to come the marking order and the result combination. In order to submit orders as soon as possible, we have used the no-blocking Socket method which did not increase the artificial detention in the module. We should control the entire timing which is from the duty to the result returns.

3.3 Real-time waveform monitor

The equipment real-time waveform in the data, provides the data interfaces of the establishment and gaining for the page profiles[6].Real-time waveform data from the devices sends every second (sub).It caches the real-time waveform data in the module in a recent internal. Module in accordance with the requirements of high-precision digital seismic acquisition, can visually display the waveform display from real-time data.

Real-time waveform has display the real-time data of all earthquake omen instruments on the window that is the horizontal axis is time, vertical axis for the numerical size. So we can show a visual precursor instrument of each station's work. Taking into account the data needs to show more of stations, so the main waveform display window design as simple as possible to the waveform display area and allow maximum space in order to make clear the station data.

3.4 Process status monitoring

This module mainly completes two function: on the one hand it completes monitoring of the device running, that is to monitor the gather processing, exchange processing, backup processing and main engine monitoring processing; on the other hand it completes monitoring of the key part availability in system, these key parts include the survival condition of gather processing, exchange processing, backup processing, database and the connection of application server. When the key part occurs an exception, the remote and real-time monitoring system of earthquake omen instrument displays the exception [7].

We define the process control interface, and the agreed division of these interfaces in the process of the module functions. We should Read the required monitoring data in the agreed interface firstly, then analysis of the monitoring data information in order to provided the assist management to the user while the page request for the information. When the monitoring system found that the exceptional survival of the state

information, it can record in the local database information in a timely, while it also reported to the superior node by monitoring the port 2327.

The performance of the system is to complete the process of running the monitoring for access to process through the interface of information. The system has checked the availability of the monitoring information which is through the port in accordance with its refresh cycle. It caches the information inside the module in order to provide the short response time and concurrent access support from the page. If no new information is refreshed more than tolerable period, it can be seen the process has lost its response.

4. The Interface Implementation of Monitoring System

4.1 The interface of the real-time status monitoring in station version

Remote Monitoring System of Seismic Network is a nationwide monitoring station for the system. As the monitoring system is the geographical differences, so in the choice of instruments will involve three versions, namely version stations, regional and national edition version. Three versions of the selected tree topology generation equipment has some differences, where details of the station edition. The figure 4 shows the interface of the equipment status monitoring in station version.

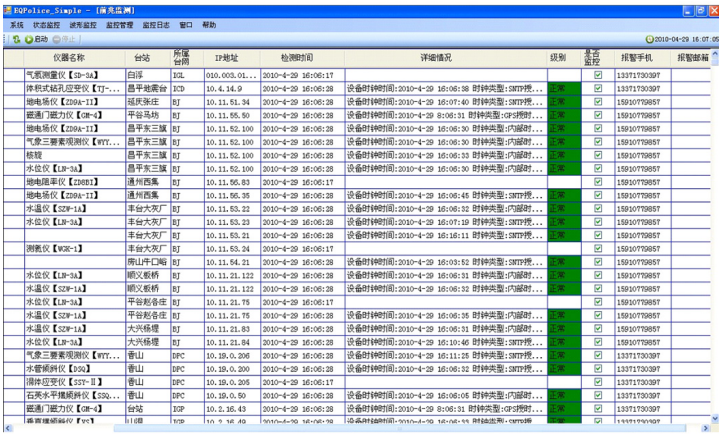

Figure.4. The interface of the real-time status monitoring in station version.

4.2 The interface of the real-time waveform monitoring in station version

Firstly, we must first choose the classification of the instruments, which include the second sampling instruments, sampling equipment or all of the equipment; secondly, we should choice the number of items per screen test [9]; and then select seismic network. The figure 5 shows the interface of the real-time waveform monitoring in station version.

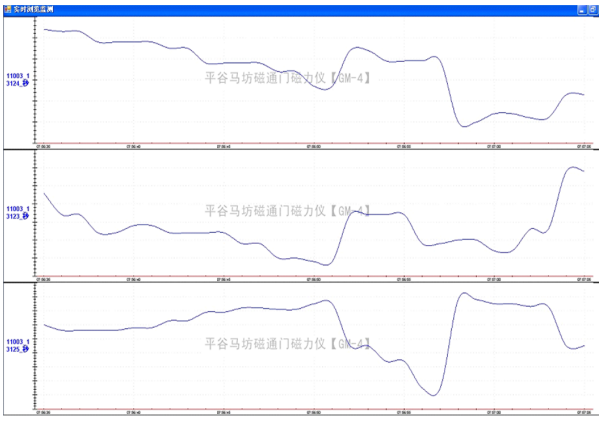

Figure.5. The interface of the real-time waveform monitoring in station version.

5. Concluding remark

Along with the computer technology and networking's development and application wide spread, the network was already ubiquitous, it seeps to various trades and occupations include the earthquake industry. The China Seismological Bureau in “the 10th five-year plan period seismic communications technology foresight for the future state: during the 10th five-year period, we will use the computer communications networks as a platform to implement seismic observation data transmission, sharing and exchange. In the data transmission aspect, the earthquake instrument's data transmission will take the IP communication protocol as a foundation; realize the data fast, the nimble transmission. To the earthquake instrument, it can support the IP communication protocol, thus, through the earthquake information service system; we will realize the observation data transmission from the Seismic station to the center of national seismic network and the center of region seismic network.

This real-time and remote monitoring system is based on Internet technology to the omen instrument. From all over the Seismic station monitoring center, to the center of region seismic network monitoring, ultimately to the center of national seismic network monitoring, it has realized the earthquake observation data collection and sharing promptly, sharpened our country's Seismic monitor ability greatly, achieves truly omen instrument's remote real-time monitor.

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