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Architecture of Web Application Industry System on Distributed Computing Platform in Forestry Information System

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Abstract:

Distributed computing platform has a great influence on the architecture of web application industry system. Based on the investigation and analysis of the current forestry information system, this paper designs a forestry information system based on distributed technology platform. This paper first discusses the development of network computing structure from the early centralized structure to the master-slave structure. Then, this paper introduces the evolution process of distributed architecture, and expounds the structure and characteristics of Microsoft's distributed computing environment active platform. Finally, the architecture of web application system based on this distributed computing platform, which is composed of presentation layer, function layer and data layer, is studied, and the corresponding development environment and technology are described. The experimental results show that the model can improve the efficiency of web application industry system.

Keywords*: Distributed computing platform, forestry information system, web application, industrial system, architecture.*

I. INTRODUCTION

With the gradual popularization of automation system, many factories and enterprises are equipped with a variety of industrial information monitoring systems, which can reflect the operation status of equipment in real time and provide a powerful means for the automatic operation of field equipment [1-2]. In recent years, with the rapid development of modern industrial technology and information industry, the local automation system which relies on artificial contact with the outside world or other parts of the enterprise has been unable to meet the needs of users. Most of the pictures, parameters and reports of the traditional monitoring

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system can only be carried out in the local operation room, and the senior management decision-makers can not grasp the production status at any time and any place [3]. Although most companies devoted to industrial monitoring configuration software have launched the function of supporting web monitoring on the basis of their original software in recent years, but due to the inadequate solution to the heterogeneous monitoring platform of different configuration software, the industrial monitoring system can not be fully integrated into enterprise MIS. At the same time, due to the development of computer network technology, many factories and enterprises have established their own computer network systems, but most of these computer network systems are limited to the application of MIS. Compared with Intranet technology within the enterprise, especially the rapid development of Internet technology, the existing computer network function is far from fully utilized. Moreover, the research in this field is relatively lagging behind in China, and the application research is less. Therefore, web-based monitoring technology has become one of the hot issues in recent years [4-5].

The configuration system based on Web meets the technical requirements of the industrial monitoring system in the aspects of system scalability, distribution and real-time. It not only becomes an important category of computer science, but also an important technical means to realize the national industrial production automation, high quality, high yield and low consumption, and improve the economic benefits of enterprises. The development of web-based monitoring system is of great significance to the transformation of traditional industries, the realization of industrial modernization and the promotion of industrial informatization. It is in this context that this topic comes into being.

II. SCHEME OF MONITORING SYSTEM BASED ON WEB

2.1 Remote monitoring system

Remote equipment monitoring includes remote data acquisition, debugging and configuration of equipment control system, remote control and maintenance of equipment [6-9]. The realization of remote monitoring of equipment is different from the local control of equipment, so it is necessary to study the degree and depth of control of different equipment. From the control mode, remote monitoring can be divided into the following categories:

(1) Maintain the remote monitoring mode. Continuously improve the intelligent level of the equipment itself, improve the ability of the equipment to deal with emergencies and the robustness of the system. Remote monitoring only sends control commands to the equipment control system, and the equipment completes the command independently. The monitoring equipment only monitors the equipment and intervenes the equipment when necessary. In this

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way, the equipment is required to continuously send equipment operation information to the remote monitoring system, and the remote monitoring system maintains the monitoring ability of the equipment. Because the field equipment has a certain intelligence, has the ability to deal with the accident on site, to prevent the further expansion of the accident and fault. When the accident occurs, it can be handled in time, or the task can be suspended, waiting for the solution of the remote monitoring system. This mode can realize the unmanned control of remote equipment, and can be applied to dangerous environment and places where human cannot reach.

(2) Complete remote monitoring mode. The remote monitoring system only sends the control command to the equipment control system, and the equipment completes the command independently. The remote monitoring system does not monitor the specific implementation process of the equipment, and reports to the remote monitoring system after the equipment completes the task. The operation control of the equipment is completely carried out by the local, and the equipment completes the processing task under the supervision of the local operators.

(3) Complete remote monitoring mode. The local control system of the equipment only controls the actuator of the equipment, and all the operation control is completed by the remote monitoring system. In this way, the control system of the equipment is separated from the equipment, and the transmission speed of the signal in the equipment control system is very high. The control system can respond to the scene immediately, and the communication line is required to be high-speed and reliable. This control method is used in some special occasions.

(4) Man machine interactive remote monitoring mode. The equipment works under the collaborative control of the local operator and the remote monitoring system, often under the command of the remote monitoring system, and the local operator controls and maintains the equipment. In the process of task execution, the connection can be established at any time to interact between devices and personnel, and the status information of devices can be collected at the remote monitoring end at any time.

2.2 Functional requirements of web based monitoring system

Web based monitoring is that the local computer monitors and controls the industrial site through Intemet / Intranet to complete the functions of state monitoring of distributed control network and equipment maintenance. Usually, the communication media, computer software and hardware system that can realize web monitoring are called web monitoring system. In the situation where the field equipment is widely distributed or the data is not easy to collect, it is necessary to monitor the operation status of the equipment in time and control it effectively, which is the demand of Web monitoring technology in industrial production [10].

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The system should meet the following tasks and requirements: (1) Web page publishing function: The system uses dynamic Web pages to publish data, which is timely and accurate, and has fast refresh speed. Customers can directly obtain real-time production data from the monitoring page through browsers and issue control instructions accordingly. (2) Data acquisition and processing functions: detect, sample and preprocess various analog or digital quantities in the production process, and output them in a certain form, such as printing reports, display screens and touch screens. Provide reliable data for production personnel and help them to analyze so as to understand the production situation. (3) Supervision function: analyze, summarize, sort out and calculate the detected real-time data and the data sent and input by the production personnel in the production process, and store them as real-time data and historical data respectively. (4) Management function: analyze the field operation condition, diagnose the fault and predict the danger by using the existing data, images and reports, and alarm the fault and emergency in the form of sound, light and electricity. (5) Control function: information processing is carried out on the basis of detection to form control output, which directly acts on the production process. (6) Provide real-time and historical data interfaces for various Web-based applications, so that the functions of the system can be expanded horizontally.

The industrial monitoring system based on Web can not only realize remote control, but also realize a wide range of resource sharing or integrate the system into the enterprise MIS. It can improve the openness and expand the functions of the real-time monitoring system by building the real-time monitoring application system in the Internet / Intranet environment. With the continuous development of network technology, web monitoring will be more applied in the management of enterprise production process. Professional and technical personnel can manage and maintain the production process through the Internet, optimize the production process, improve the availability of equipment, and ultimately reduce production costs and improve efficiency.

2.3 Advantages and disadvantages of web based monitoring system

The monitoring system based on web is based on B / S structure. In this structure, the user interface is completely through the web browsing technology, combined with a variety of script languages of the browser to form an efficient software system.

With the help of Web monitoring, the information network (intranet) and control network in an enterprise can be effectively connected, so that the production manager can grasp the production situation at any time, so that the production situation of the enterprise can be closely combined with the management strategy, and the comprehensive automation of the enterprise can be realized. Through web monitoring, real-time collection and fast centralization of field

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operation data can be realized, and field monitoring data can be obtained, which provides a basis for remote monitoring. Through web monitoring, technicians can monitor and control the operation status and various parameters of the production system and field equipment without going to the scene or harsh environment, and conveniently use the rich local software and hardware resources to monitor and control the remote objects. In order to maintain the normal operation of the equipment, so as to reduce the number of on duty staff, and finally realize the remote unattended or few people on duty, to achieve the purpose of reducing staff and increasing efficiency.

But there are still some problems. First of all, the coexistence of multiple structures in network communication. At present, the structure of Web monitoring system is more complex, and the distribution distance is long. There are also different LAN, different platforms, and even the operating platform and programming language in the same LAN may have different problems, which requires the integration of different platforms in the network to achieve mutual communication. Secondly, the traditional monitoring methods are basically database centric solutions, the whole process is around the real-time database server. This method has many shortcomings in practical application. Thirdly, in the design of web-based monitoring system, real-time problem is a technical difficulty, so far there is no very mature and authoritative solution. In the existing network technology conditions, it can not completely achieve real-time control, it always has a certain delay. This requires that in the process of web-based monitoring, various measures should be taken according to the actual situation to make up for the delay of data transmission on the network and provide the real-time performance of the system. Finally, when adopting C / S structure, both the client and the server can handle tasks. Although the client has higher requirements, it can reduce the pressure of the server. But using B / S structure, the client can only complete simple functions such as browsing, querying and data input. Most of the work is undertaken by the server, which increases the burden of the server.

III. DESIGN OF WEB MONITORING SYSTEM IN HETEROGENEOUS NETWORK

3.1 Network structure of the system

The structure of Web-based industrial information monitoring system under heterogeneous network is shown in Figure 1: the field monitoring layer is composed of industrial control computer and industrial field devices including PLC and other intelligent devices. The industrial control computer collects the data of intelligent devices through the field bus to realize the field monitoring of production. The web service layer is composed of web server and database server. The web server mainly provides monitoring pages for users, and the database server provides real-time data and historical data for monitoring pages; The web monitoring layer is mainly the users in the enterprise information network. Users do not need to install the client

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program, they only need the general browser (such as IE) to monitor the scene through the network; Finally, through the firewall technology, the enterprise LAN is connected with Internet, so that users can monitor the industrial site anywhere they can connect with Internet.

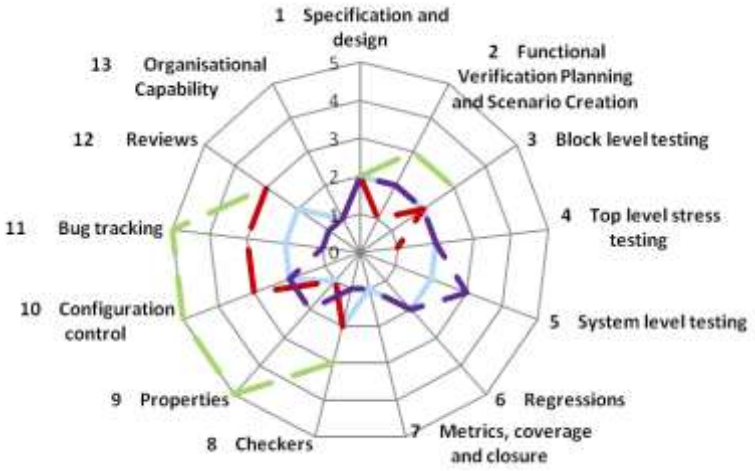

Fig 1: Structure diagram of real time monitoring system based on Web

3.2 Data interaction between field monitoring system and web browser

In the way of communication module as the center, the field monitoring system and web browser realize data sharing based on data exchange technology. Data exchange technology is based on the technology, protocol or standard of data exchange between windows programs. At present, the most commonly used standards are DDE, OPC and so on. OPC is widely used because of its more extensive openness. So the system uses opcda technology to realize the data exchange between the field monitoring system and the web monitoring layer.

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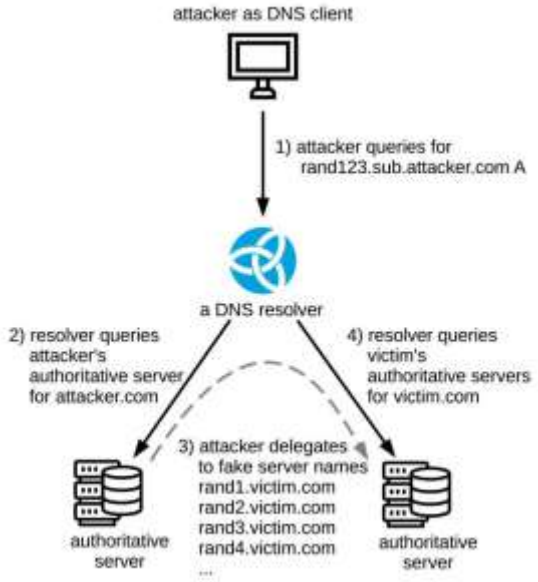

Fig 2: Integration of heterogeneous network interface layer

OPC client is packaged as communication module by ActiveX control. When users have monitoring requirements, access web server, Download monitoring page and monitoring modules from server, especially communication module, then communication module establishes connection with remote OPC server, and real-time data exchange is conducted between them. The process is shown in Figure 2. Because OPC server and OPC client are not on the same machine, remote server should be used for OPC server. In remote server, DCOM distributed components are used. Components and client programs run on different machines, and the machines communicate through the network.

As long as the OPC server is installed or configured, the industrial computer or various intelligent systems in the field monitoring layer can establish a connection with the communication module in the browser. The industrial computer with monitoring configuration software is used as the data source of Web monitoring in this system. At present, all kinds of industrial control configuration software have integrated OPC server, which is automatically added in the installation process of configuration software, and users can use it directly. Configuration software OPC server is a DCOM application. Through this program, the variables in the configuration system are provided to the OPC client, and the user can read and write the variables in the configuration system in the client.

3.3 System security considerations

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The industrial information monitoring system based on web runs on the fully open Internet, so the security of the system must be considered. Especially, the web monitoring system formed according to the design idea of this paper can access the w-qu server and download it to the corresponding HTML file and the activcx communication module, and then obtain the control right to the field monitoring system. As a result, there are great potential safety hazards, so we must have comprehensive safety considerations. First of all, the most important thing is authentication. When a user visits a web server, the server should first require the user to enter the correct login account and password. Only after the system confirms, the system will respond to the user's requests and allow the user to download the corresponding pages and controls. Secondly, when the confidential information is transmitted on the Internet, it can be considered not to appear in plaintext, and the confidentiality of the information can be guaranteed by information encryption technology. In order to prevent the information from being intercepted, read or even destroyed, ensure that the data is transmitted to the browser client in real time and accurately.

IV. REALIZATION OF WEB MONITORING SYSTEM FOR DIE FLAT STEEL PRODUCTION

4.1 Systems analysis

The main functions of the real-time monitoring system for die flat steel production based on web are as follows: (1) Equipment running status monitoring and data dynamic real-time display; (2) Inquiring, modifying and selecting the production formula; (3) Record and alarm the faults in the production process; (4) Management of operator and administrator authority. The functions of the system are shown in Figure 3.

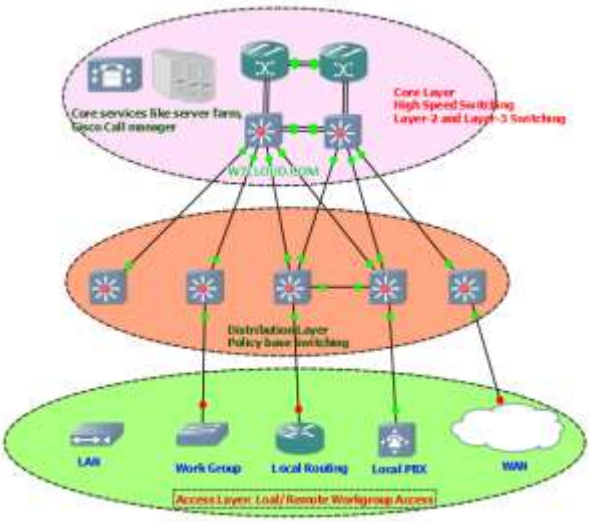

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Fig 3: The functional structure of the system

The design structure of flat steel production monitoring system is shown in Figure 4.

In order to realize the function of Web monitoring on the site, we must first have a site monitoring system which can stably control the production process in the industrial site. On this basis, the connection between enterprise information network and on-site monitoring system is established. Finally, there should be a human-computer interaction interface to enable users to obtain the field operation. The industrial computer is used as the hub of information network and control network to monitor the production process control system, and the real-time data and control information are exchanged through the web page. The client uses the browser to access the server through the Internet / Intranet mode to form a web-based industrial monitoring system, which is a general low-cost solution.

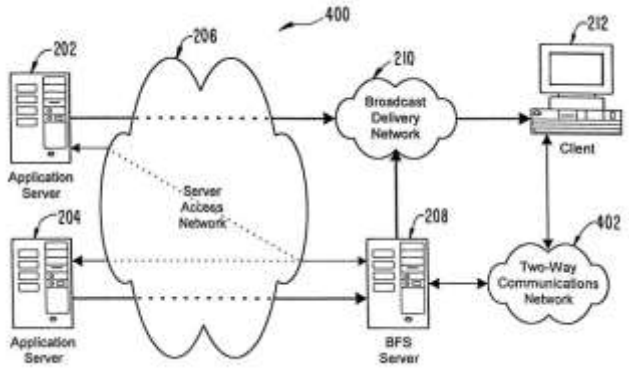

Fig 4: Structure diagram of production monitoring system for die flat steel

4.2 Implementation of web based monitoring system

Network integration of system

According to the analysis of this paper, in order to realize the information sharing of control network and information network, we must first realize the integration of control network and information network, that is, the isomorphism of network. Network isomorphism can be divided into network layer isomorphism and interface layer isomorphism:

(1) Isomorphism of network layer

According to the analysis of the actual situation of the factory, the field industrial control computer is regarded as a node of the enterprise internal LAN, so that the industrial control computer is not only used as the upper computer to realize the connection of the control

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network and the purpose of collecting the field data, but also as a node of the information network, so that the field data can be shared in the information network. The integration of workshop level control network and enterprise level information network layer is realized.

(2) Isomorphism of interface layer

The isomorphism of the network layer provides the necessary conditions for the information sharing between the control network and the information network, but it still needs to realize the data exchange through a certain communication protocol in the LAN. On the server side, the on-site monitoring system is realized by the Siemens monitoring configuration software WinCC. WINCC comes with OPC server, which is a DCOM application. Through the software interface, WinCC OPC server uses WinCC variables to provide the required information to OPC client. WINCC OPC server is added automatically during WinCC installation, and can be used directly without additional configuration.

4.3 Implementation of each module in the monitoring page

(1) On site operation status detection

This part only allows users to view the status, without the right to modify the data, so the control of analog data display instrument is used to dynamically display the data on the monitoring page. Whenever new data from the communication module arrives at the OPC client, the data change event will be activated. In this event, the changed data will be assigned to the attributes of the corresponding instrument control, so that the instrument can display the current value of the point state in time.

(2) Modification of equipment operation parameters

This part of information determines the moving range of flat roll and vertical roll at each step. The accuracy of data determines the quality of products and whether the equipment can operate safely. Considering that the amount of data is not very large, the system uses synchronous writing when modifying OPC server data. Users modify the parameters on the client side, and then send the data to the server side through the button, so as to modify the operation parameters on site.

(3) Processing of alarm information

The alarm information shows the current system failure and the cause of the failure, in order to remind the operator or administrator to make the corresponding response. The emergence of alarm information is realized by the change of a storage word in the PLC middle storage area. If the word changes, the alarm information control reads the storage word from the communication control and judges which bit has changed, so as to get the fault reason. At the same time, according to the user's needs, each alarm information (including the date, time and

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content of the failure) can be saved to this machine for future analysis and summary.

V. CONCLUSION

The industrial information monitoring system based on WCB is different from the general management information system. Its characteristics are mainly reflected in three aspects: real-time data transmission, event driven data and active data source transmission. In view of the advantages and disadvantages of the existing real-time monitoring system, this paper analyzes and studies the industrial information monitoring system based on web by combining computer technology, network communication technology and monitoring technology.

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