



Research Article

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Research on the novel network pattern of enterprises under WIFI environment

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ABSTRACT

To establish networked sharing platform for manufacturing resources and form a quick response center can make each enterprise exchange mutually and improve resource utilization rate. For this reason, this paper proposed a novel network pattern of enterprises under WIFI environment. It will be one of effective ways to boost competitiveness of manufacturing enterprise groups.

Key words: Novel Network Pattern; WIFI Environment; Manufacturing Enterprise

INTRODUCTION

Rapid development of network technique and every-changing software technology bring new opportunities and challenges for manufacturing and meanwhile make the competitions with the goal of product quality and response speed become fiercer [1-2]. Modern manufacturing enterprises increasingly pay attention to improving design and manufacturing level through optimized manufacturing resource allocation and reasonable and efficiency utilization so as to attain quick response to the market [3-4].

Limited by scale, capital and technical conditions, it is difficult for some subordinate enterprises of modern manufacturing enterprise groups to purchase large-scale cutting-edge equipment [5]. The manufacturing resources with core competitiveness are inevitably single and limited. Precious and superior resources owned by other subordinate enterprises leave unused due to low utilization rate [6-7]. To establish networked sharing platform for manufacturing resources and form a quick response center can make each enterprise exchange mutually and improve resource utilization rate. It will be one of effective ways to boost competitiveness of manufacturing enterprise groups.

Wireless sensor network (WSN) owns perception, calculation and wireless communication abilities and control function. It is widely applied in such fields as national defense, military affairs, environmental monitoring and agriculture. WiFi (wireless fidelity) is a short-distance wireless communication protocol which is widely applied currently. It has the advantages of low cost and convenience for deployment.

RELATED TECHNOLOGIES

(1) WiFi Sensing Node. WiFi sensing node is composed of 3 parts: sensor module (SH11/TSL2550), processing and wireless communication module (GS1010) and power supply module. The sensor module integrates SH11 and TSL2550 sensors. Processing and wireless transmission module adopts SoC chip GS1010 with low-power dissipation and high integration density, responsible for data storage, processing and wireless receiving and sending of the whole sensing node. Power supply module provides the energy for normal operation of the sensing node. GS1010 SoC chip uses two ARM7 processors, including an application processor. Flash and SRAM storages are integrated internally. Two ADCs, I2C and GPIO interfaces are extended externally to receive analog information and digital information collected by the sensor. Another processor integrates MAC/PHY layer of 802.11b/g, mainly in charge of receiving and sending wireless data. This chip supports IEEE802.11b/g protocol stack.

(2) Sever software platform. J2EE technology is adopted for server-side software development of this system. The system platform includes view layer, business logic layer and data access layer. The view layer adopts Ajax+Jsp technology. The client can use multiple ways to display interior and outdoor environment information. The client based on Ajax non-refresh technology and asynchronous communication technology sends request to the sever side in a regular and active manner so as to gain the latest environment information. The business logic layer adopts Servlet technology to respond to various requests sent by the client. It utilizes Socket to monitor whether data packet arrives at the network and can send instruction data packet according to changes in indoor and outdoor environment. The business logic layer should be not just responsible for unpacking, analyzing the data packet received and sending relevant information to internet with Servlet technology, but also packing user instructions received by Servlet and then sending to wireless sensor network so as to realize mutual fusion of WSN and Internet. The data access layer adopts Hibernate technology to attain database access. Hibernate technology adopts object/ relational mapping model to effectively shield bottom-layer database, provide data operation interfaces for business logic layer and realize modularization of software development. Server software mainly includes the following 2 functions.

1) To collect and manage wireless sensor network node data. The functions are further detailed to network interface, data extraction and classification as well as localization algorithm interface etc. They are mainly responsible for receiving the data packet from wireless sensor network node, processing relevant data after decomposing the data packet, completing environment monitoring and managing sensor network. Localization algorithm interface reads related configuration files of node location and transforms node location. After the server starts up, it waits for client request. The client makes a request to the server. The server accepts the request and judges the request type. The main request types include indoor and outdoor environment real-time monitoring, historical records query, control WSN command, node location and general commands. When the server receives client request for indoor and outdoor environment real-time monitoring, the server monitors WSN data packet via Socket. If the monitoring is unsuccessful, it will continue to monitor; if the monitoring is successful, it will accept the data packet, analyze it, feed back the data packet analyzed to the client and type it into the database. When receiving the request of other types, the server will maker corresponding processing according to different requests. The server feeds back the processing results to the client. If the serve receives service off command, it will quit the service.

2) To organize and manage monitoring data. This part mainly involves database interface, data processing, command sending interface and Web interface. When Web interface finds the request to modify network attribute, it will send the command to modify network attribute to sensor network. The server software sends the packed data to Web interface, responds to data request of browser part, completes database storage of the data collected, records the log, receives database index request send by Web interface, extracts corresponding data to Web interface and pack node-related information (including location information).

DESIGN OF NETWORK SHARING PLATFORM

(1) Design Requirements. Network sharing platform for manufacturing resources aims to provide uniform 'intermediary' services for scattered manufacturing enterprises in a group, set up a bridge among each collaborative manufacturing enterprise and realize optimal utilization of manufacturing resources and information sharing. The design pf this platform should satisfy the following requirements:

1) Realize flexible inquiry and online retrieval of resources and information of each manufacturing enterprise, reach dynamic management of manufacturing resources in a group and provide reliable manufacturing resource information for arranging and implementing manufacturing plans.

2) Timely publish manufacturing resource use and latest allocation situation on the internet so that related manufacturing enterprises can timely master the latest resource use conditions.

3) Users on each platform should have the communication channel on the platform.

4) Manufacturing resources owned by each member unit are covert to each non-member unit, so the platform should have good security mechanism, including validity verification for log-in and restricted use of system management function.

Development of the platform system should be able to promote sharing of various kinds of information in the group, timely know resource conditions of each enterprise, improve work efficiency and enhance harmony and consistency of decision-making.

(2) System Architecture. Networked sharing platform system for manufacturing resources is an open distributed system. The platform system adopts the service ode based on network interconnection. Users need to gain services

via internal network of the group. System construction, operation, maintenance and security are done by platform administrators at the server side. The user side should be as simple, convenient and practical as possible. Compared with traditional T/M and C/S modes, Web-based B/S network calculation mode concentrates all software development, maintenance and upgrade jobs on the server side. Users only need to regard browser as the operation platform for network application. This attains thin user side and reduces the pressure of user side. Thus, the architecture of this platform system adopts three-layer architecture of B/S mode.

The top layer is application presentation layer, including system display logic. It is client browser, i.e. end-user layer. The functions are related to users' limits of authority. The Web server of the platform will verify the identity of the login user. Authorized legal users can log in the platform via Web browser at any place in the group. They can call various functions of the system according to different limits of authority and roles.

The middle layer is business functional layer, including transaction processing logic of the system. It is Web server layer with application extension function. This layer is used to provide the functions of the whole system and service operation. It provides upward connection of operation interface of users with various limits of authority and transaction processing and supplies downward support of the data layer.

The bottom layer is data service layer, including data processing logic of the system. It is database server layer. This layer is used to manage and store all data documents by which for the whole platform system operates, including a series of structural data related to database storage such as user information, resource information, news and notification message, voice message. The data service layer adopts efficient ADO. NET data access and storage technology provide uniform data services to ensure data sharing of the whole platform and data consistency.

REALIZATION OF NETWORK SHARING PLATFORM

This platform system takes ASP.NET technology as network development tool, adopts WindowsServer2003 as the server operation system and uses SQLServer2000 database system and Microsoft Visual Studio. NET as webpage development platform. Visual Studio .NET provides Integrated Developing Environment (IDE) to create applications on the platform. Programmers can use one or more .NET authoring languages to write their codes. ASP.NET is a programming frame constructed on new generation of .NET platform architecture of Microsoft. It applies Common Language Runtime (CLR) to establish strong enterprise-level Web application services at the server backend. When users request a page, the code is compiled at the backstage to Intermediary Language (IL) when the page operates the first time. Only IL code operates in CLR. Therefore, all .NET languages are compiled to the same IL. Static HTML page processed is only seen at the client. This decreases the possibility of hostile attack of the website and enhances website security.

This paper takes a key laboratory as the center and involves colleges, scientific research institutions and some specific enterprises to establish networked sharing platform system for manufacturing resources. In accordance with platform design requirements mentioned above. This system uses database access module to achieve data transmission between each function module and database.

1) User login module. In essence, this system is an internal service platform in the group. User identity can be confirmed according to two ways: the administrator provides login information for each user; users apply for registration in the login interface and the administrator approves.

The user group of this system is relatively stable. User login module is mainly responsible for checking the validity of user identity. Users input identity identifying information in the login interface and the system seeks in the information stored in the database according to the key words submitted by users. If the system finds the corresponding information, the users pass user identity verification, meanwhile the system will judge user right and conform the system functions which can be used by users.

2) Information center module. Information center module mainly includes browsing and viewing functions of news and notification message. In accordance with people's reading habit, the system displays news and notification message in paging form and sorts the message according to time sequenced. Users can gain detailed message contents in line with the title, source and other key words of the message.

3) Resource retrieval module. According to the classification of manufacturing resources, resource retrieval module is classified into resource retrieval of industrial design technology, human resource retrieval of manufacturing technology, resource retrieval of proprietary knowledge reserve, logistics system resource retrieval of manufacturing process and resource retrieval of enterprise alliance. Each part can provide query of basic information of corresponding resources. Users can carry out field sporting and condition screening for the information list as needed. Based on the classification, the system displays all resource data in the database in paging form and lists

according to relevant key attributes. Users can adjust the resource sequence in line with the resource attribute through simple operation of the table header. When it is necessary to limit the conditions for resource display, the keyword input box and attribute drop-down list box receive relevant data inputted by users and submits to the backstage to inquire the data. Then, the list will return all resources complying with retrieval conditions to realize condition screening of resource data. The detailed data of each attribute index of current resources can be seen through keyword hyperlink.

4) Dynamic information management module. The function of dynamic information management module is to maintain the system. It manages and maintains text information in need of update, including adding and deleting news information and notification message, checking and deleting messages. So, safety verification mechanism of embedded function inspection is adopted. This module is only open to system administrators. In each management function webpage protected, identity inspection function of operators is embedded. Any user will go through right verification before the access. If the user is legal, the user is allowed to operate, or else error warning will pop up. During adding news and notification message, directly reading in system time can reduce workload of the administrator and reduce misoperation of the administrator. After the message written by the user is checked, the user can be allowed to normally publish the message on the message board. This completely eradicates invasion of bad information in the system.

5) Basic data management module. Basic data management module manages and maintains static information stored in system database such as user information and resource information, including adding, modifying and deleting system user information and basic manufacturing resource information. Similarly, it adopts safety verification mechanism of embedded function inspection to completely eradicate intrusion and misoperation of illegal users. User information adding page adopts Identification inspection and repeated password input design to enhance normalization of operation. User information modification implements respective list display mode for common users and administrators so that the modification work is more targeted. User information deletion belongs to unrecoverable operation. When user data are completely deleted, repeated confirmation can avoid misoperation of administrators and ensure safety of user information deletion.

CONCLUSION

This paper designs and implements the novel network pattern to enterprises under WIFI environment. It will be one of effective ways to boost competitiveness of manufacturing enterprise groups.

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