Enterprise Cluster Intelligent Manufacturing Information Management System Based on Wireless Communication Technology

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Abstract. The existing intelligent manufacturing information management system of enterprise cluster has not reached the optimal path when designing the system security. In order to improve the security of the system, the intelligent manufacturing information management system of enterprise cluster is designed based on wireless communication technology. In the design of hardware system, the information processing module is designed to reduce the time used for data reading and writing, and the circuit system of wireless communication technology is designed to enhance the security of data transmission. In the design of software system, the whole function of the system is designed, the optimal path algorithm is designed, and the security of information management algorithm is strengthened. Through experiments, we can see that the function of the intelligent manufacturing information management system of the enterprise cluster is tested, and the integrity of product data management module, system functional framework module and production implementation management module is tested. The security of the system is tested and it is found that the system has enough security when the data transmission unit is below 25 bits.

Keyword: Wireless communication technology · Enterprise cluster · Intelligent manufacturing · Information management system

1 Introduction

Enterprise cluster usually refers to a large enterprise with many related industries, or many content related industries are associated with each other in the form of a collection. This combined operation mode can make the enterprise have better work effect. In actual production, due to the increase of production scale, in order to have enough work efficiency, enterprises usually use intelligent technology to optimize the manufacturing process. Technicians can use network technology and automation technology to complete the management of intelligent manufacturing related information, and use the efficient collection of production information to improve the quality of management work [1]. In the process of enterprise development, due to the influence of various external technologies, it needs to keep pace with the times in the development. Therefore, it is necessary to design a fast and convenient enterprise cluster intelligent

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manufacturing information management system, through which the enterprise related information can be counted and managed to realize the rapid development of the enterprise. At present, the common systems include intelligent manufacturing system based on MES. Aiming at the problem that the low level of manufacturing process informatization restricts the production efficiency of small and medium-sized enterprises, this paper designs and develops an intelligent manufacturing system based on MES. The system completes the rapid data exchange and process control through industrial Ethernet, uses MES to collect the operation information and working status of all equipment, real-time deployment of the process, and realizes the storage and reclaiming of the system, Intelligent control of production process such as detection and identification, sorting and positioning; So as to realize the informatization and digitization of manufacturing process, and effectively improve the operation efficiency of enterprises. Advanced intelligent manufacturing plan management system based on digital twin. The plan management system can't adjust automatically according to the uncertain factors under the mode of multi variety and small batch manufacturing, A framework of intelligent manufacturing planning management system based on digital twin is proposed. The PDCA business process model of planning management is established. The processing logic and constraints of the cycle rolling model of static scheduling and the optimization model of dynamic emergency scheduling are proposed, It is verified that the management mode proposed in this paper can support the dynamic adjustment of intelligent plans with different orders and resource status, and improve the efficiency of dealing with uncertain factors. Although these two more advanced systems effectively promote the development of enterprises, there are problems of poor communication quality and poor real-time update speed in the process of using them.

Therefore, in the current development of manufacturing industry, the research of enterprise cluster intelligent manufacturing information management system plays an important role. Most of the existing information management systems only focus on the management function and operation implementation action requirements, but ignore the security requirements of the system itself. Therefore, this paper designs the enterprise cluster intelligent manufacturing information management system based on wireless communication technology, and makes a new design for its security.

2 Design of Enterprise Cluster Intelligent Manufacturing Information Management System Hardware Based on Wireless Communication Technology

2.1 Design Information Processing Module

In the hardware design of enterprise cluster intelligent manufacturing information management system, the response mechanism of information fast processing module is the most core peripheral module, and its composition structure is shown in Fig. 1.

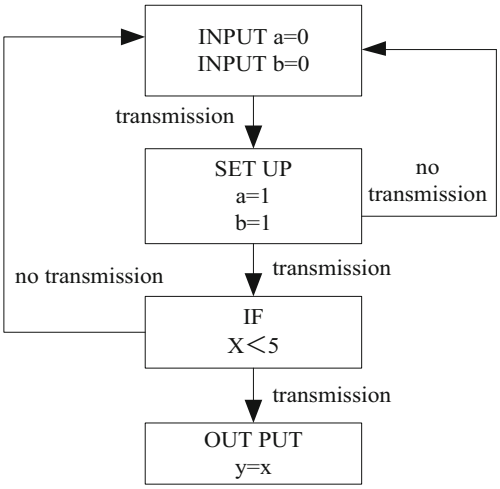

Fig. 1. System hardware fast response conversion module

As shown in Fig. 1, in the bus with equal bandwidth, if the ABP bridge in neutral position is used as the main template, if the three states of space, setup and output can be perfectly controlled, the read and write data can be quickly converted to the safe area and transmitted to the designated location [2]. In the timing chart of read-write transmission, the address information is consistent with the selection signal. When the status of the selection prompt box reaches a certain degree, it means that the read-write transmission data can be up sampled, and the reading sampling time will be improved to a certain extent compared with the traditional sampling storage time.

2.2 Circuit Design of Wireless Communication Technology

In the design of wireless communication module, the most important is to collect information based on wireless communication technology. The main control center of the system is a kind of control chip which can realize information collection, and also has certain operation transplant function. Embedding such chip into the wireless communication information collection system can greatly enhance the management ability of the operating system. In the embedded chip setting, the power management ability of the visual acquisition system and the design of low power consumption management program can be realized through low power energy conversion. The overall framework of the information acquisition system is shown in Fig. 2.

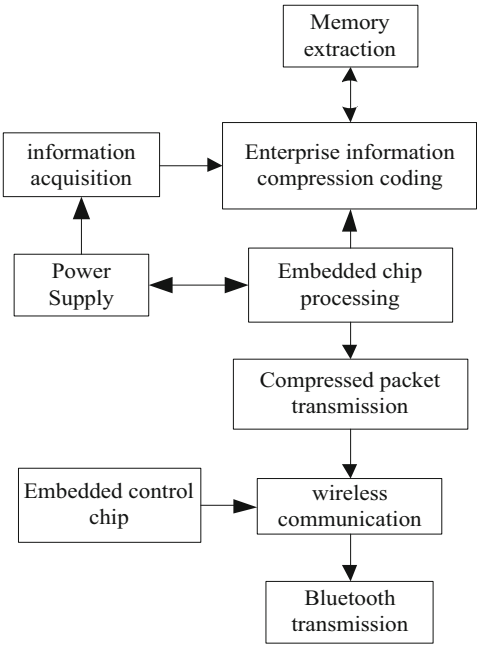

Fig. 2. Overall design of wireless communication technology

As shown in Fig. 2, the embedded chip management system extracts memory and transmits compressed packets through a compressed and coded information management mode. When the transmission efficiency of enterprise information is more than 50 FPS (Frames Per Second), the energy loss of image transmission can be converted. In this process, if the information management system can complete the analog conversion of clock generator or A/D (Analog.Digital) conversion, the output mode of information management signal can be controlled. Through Bluetooth transmission interface, the resolution setting of video program compression and coding can adjust the process of information transmission, that is, it can be equipped with a 220 V power supply in the chip of embedded information acquisition system. In the control end, the communication connection of Bluetooth transmission function is also an important step. This information transmission program based on embedded chip can provide a compatibility channel for the existing Bluetooth devices, and its YSB interface can realize the physical connection with the host of the computer device control end, and then realize the connection channel between voice and text conversion.

In the initial circuit design, the above embedded chip information acquisition system provides part of the power output conditions. At this time, the output device adopts 3.0 V standard voltage.

However, after a certain period of testing, it is found that the overall design of the circuit as shown in Fig. 3 needs to achieve the purpose of grounding anti-interference through the zero point group, so different power line numbers need to be used to make these grounding lines bypass the interference and complete the information transmission

and identification of the whole system module [3]. In this process, two 30 Ω resistors can be used as the matching resistor of Bluetooth transmission module, and five external grounding power supplies can be used as the output of line impedance.

3 Design Enterprise Cluster Intelligent Manufacturing Information Management System Software

3.1 Overall Function Design of the System

First, in the development and design of manufacturing data management system, technicians should first complete the perfect database design to meet the needs of subsequent production management. In the production management, the integrated information management system needs to compile, modify, delete and retrieve the data table combined with the collected data [4]. In the actual design and research, the above functions can use SQL (Structured Query Language) database to complete the collection and storage of production attribute data, and Mongo DB (Data Base) to complete the storage of production implementation data [5]. In the attribute database, the main data content includes production raw material data, product data, order data, order product data, warehouse data, equipment operation data and function staff data. The following table is the main data list in database design.

Second, the design of data receiving module. Data receiving module can use PDM as the basis of design in product data management. If the manager needs to change the product data, the management system can send the change data to the PT system, and then the production management department can complete the change of the raw materials and parts data in production combined with the data to be changed, so as to complete the data collection and change.

Third, data acquisition module. The technical basis of data acquisition module is OPC (OLE for Process Control) technology, which is connected with manufacturing equipment by means of multi-layer interface, and completes the exchange of production data by means of server and network to obtain real-time data of manufacturing process. In the current design, production data is usually collected by periodic sampling and subscription [6]. Periodic sampling data is information collection, the client obtains the data of the server within a certain time and frequency, and the subscription method is to automatically send the data changes with the help of the server, which reduces the workload of the server. In data acquisition, different types of information can be collected in different ways. For the signal data with fixed change period such as temperature and speed, technicians can use the periodic sampling method. For some sudden information such as alarm data, technicians generally choose the subscription mode to improve the real-time of on-site data acquisition.

Fourth, data transmission module. The main function of the data transmission module is to push and transmit the data of the production site, so as to realize the real-time supervision of the production site. The data acquisition module will exchange data with the help of network technology and server, so as to complete the real-time push of client information and ensure the normal management work [7]. The functions of data transmission module include creating information transmission channel, real-time data transmission and channel automatic closing, which ensure the normal management.

Fifth, the general assembly business module. The first mock exam of the module includes the editing of the parts used in the production process, the management of the equipment commands and the production of raw materials in the manufacturing process, and the data collection and management of material consumption and production cost in the manufacturing process, so as to ensure the correct understanding of the whole production process and ensure the high quality of the management work.

Sixth, sales management module. The integrated information management system also needs to manage the sales process of the products. The system can use ASP platform to complete the processing of order data. After the order information analysis is completed, the marketing department can configure the products according to the demand of the order. The configuration process shall be carried out strictly according to the customer order requirements to ensure the marketing quality [8]. After the product is configured, the system can form the only product production code. The marketing department can use this code to statistics and manage the orders, and form the demand plan by integrating the data to ensure the comprehensive management quality of the system.

Seventh, purchasing management module. The main purpose of this function module is to combine with other system modules to complete the whole process management of material transportation and use. The procurement management module is mainly used to collect and calculate the data of raw material procurement, supply and transportation, which helps to strengthen the management process of materials, reduce unnecessary production costs, and improve the manufacturing and production benefits of enterprises.

Eighth, data comprehensive query module. In the information management process of manufacturing process, the system should not only complete the collection, transmission and processing of all kinds of manufacturing information, but also have the function of retrieval and query, which is convenient for managers to query some previous data and optimize the manufacturing process [9]. The retrieval function of the system ensures that users can search the corresponding information, and complete the efficient management of the whole process of manufacturing with the help of a unified data system. In the design of the system, in order to ensure the safety of management, enterprises can set certain operation authority to avoid some criminals stealing production information.

3.2 Security Design of Information Management Algorithm

Its principle $A*$ search algorithm, when analyzing and introducing the algorithm, the heuristic search algorithm should be introduced first. The algorithm can search for other nodes based on known nodes, and can obtain other related methods based on heuristic functions, calculate and select the safest node as the next search node. When searching for other nodes, both bfs (Basic Frame Synchronization) and dfs (Distributed file system) use a blind search method, so they will not select nodes through heuristic functions. If you are unlucky, you may need to test all the solution set spaces before you can get the results. Therefore, this algorithm is generally only used in clear conditions where there is only a small solution space. There are obvious differences between Bfs, dfs and heuristic search. The heuristic search algorithm is to obtain the

optimal solution or better solution in a very short time. A solution can be obtained by calculating the heuristic function. How to design this heuristic function Is the key. The $A*(A-Star)$ search algorithm is mainly to find the safest path in a graph with multiple nodes. It is a heuristic search algorithm. The formula is:

$$f(n) = g(n) + h(n) \tag{1}$$

Among them, $h(n)$, $g(n)$ and $f(n)$ respectively represent the estimated cost, the actual cost and the function from the target node to the departure node. The $A*$ algorithm will use a structure similar to the bfs algorithm to select the priority queue during calculation, and determine the value of the fhs of the possible child nodes by calculation, and will stop the calculation until the target child node or the priority queue is determined [10]. If the estimated cost value of the $A*$ algorithm is 0, it is relatively similar to the DFS algorithm, and if the actual cost value of the $A*$ algorithm is 0, then it is relatively similar to the bfs algorithm. In the former case, only calculation of $g(n)$ is needed to determine the safest path. The most distinctive feature of the $A*$ algorithm lies in the design of its evaluation function. Therefore, the quality of the $h(n)$ design directly affects the efficiency of the $A*$ algorithm.

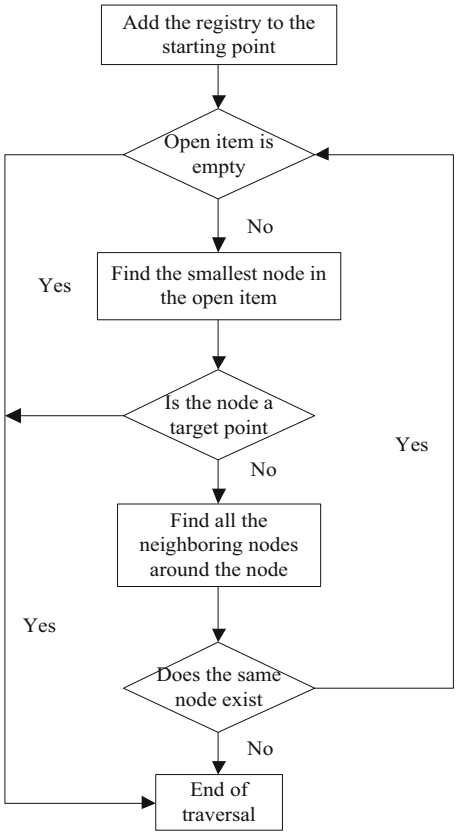

Fig. 3. Algorithm design

As shown in Fig. 3, the principle of the $A*$ algorithm is that when selecting subsequent traversed nodes, it is usually completed by each node that has not been traversed, but the node with the least value is selected to replace the node with the smallest value among the detected nodes. For example: Find the shortcut of V0 → V5. In the process of V0 → V5, you can reach the final node V5 through V1, V2, V3, and V4. When solving the best path in a static network, the $A*$ algorithm is a direct and effective algorithm. Whether the valuation function can be selected reasonably will directly affect whether the shortest path can be accurately determined. The similarity between the actual value and the estimated value can reflect the selection of the valuation function. If the value of the evaluation function is 0, then only the calculation for $g(n)$ is needed to determine the minimum path. However, the smaller the evaluation function, the more nodes, which will increase the workload of calculation and consume more time in calculations, that is, the smaller the evaluation function, the higher the security of the algorithm.

4 Experimental Study

4.1 Experiment Preparation

This experiment compares the system design in the article with the traditional enterprise cluster intelligent manufacturing information management system to determine whether the system designed in this article is practical and safe. The environment configuration used in the experiment is as follows: CPU uses Intel(R) i5-2440@3.40 GHz processor, running memory is 4 GB, and storage space is 128G. The operating system of its software platform is Windows 10 64 bit, the web database is established through Tomcat 6.0 software, its back-end database uses MySQL, and the MyEclipse system is used for back-end development in the J2EE environment, and the back-end program development language is Java.

The design of the online teaching system for financial management courses in this article is based on the B/S structure, mainly the information interaction between the browser, the WEB server and the database. The user sends a request to the WEB server through the client browser, and the WEB server receives the request and It exchanges information with the database. After receiving the request from the WEB server, the database performs corresponding operations and returns the running result to the WEB server. The WEB server generates code and returns it to the client browser. The browser interprets the HTML code and displays the content of the web page. After setting up the above experimental environment, you can start the test of system functions and system performance.

4.2 System Function Test

Functional testing is the most basic test in system testing. It does not matter how the software is implemented internally, but only verifies whether the product's functions meet the requirements specifications based on the requirements specification and the test requirements list. It mainly checks the following aspects: First, function Whether it

is fully realized, and whether there are any omissions; second, whether the function meets the hidden requirements of user needs and system design; third, whether the input can be correctly accepted and the correct result is given. The specific test situation is shown in Table 1.

Table 1. Functional test results

System module	Subsystem	Test results
Product data management module	Operating system management	Normal
	Product structure management	Normal
	Product configuration management	Normal
	Material management	Normal
	System maintenance management	Normal
	Manufacturing process management	Normal
	Product code management	Normal
System function framework module	Personal work interface	Normal
	Information management system	Normal
	Project management system	Normal
	Process management system	Normal
Production implementation management module	Real-time data collection system	Normal
	Data management system	Normal
	Data display system	Normal

In summary, the test results show that each function can be used normally, and the function is complete, the interface is friendly, and the interaction is good.

4.3 System Security Test

The enterprise cluster intelligent manufacturing information management system, as a B/S-structured Web system, not only needs to have beautiful pages, practical functions, but also strong security requirements, otherwise it will cause data loss and system paralysis. Because this system is directly facing Internet users, it may be threatened by more attacks on the network, and it is very necessary to test its security. The goal of security testing is to find the security flaws in the system design as much as possible, and then make the necessary repairs. The security test of this system includes testing whether there are security vulnerabilities in the login of the system, testing whether

there are security vulnerabilities in the script program on the server side, testing whether the system management code is safe, preventing users from bypassing the program and directly accessing the background program, testing the Tomcat system server platform Whether the security settings are appropriate and so on.

Take security as the evaluation index of the enterprise cluster intelligent manufacturing information management system, as the basis for analyzing system performance, perform system classification performance testing, and analyze the integration capabilities of different systems for information resources. The formula for calculating the security of the enterprise cluster intelligent manufacturing information management system based on wireless communication technology is as follows:

$$Q_i = \sum_{t}^{N_i} b_t(i) N_i \tag{2}$$

In the formula, Q_i represents the probability of the information management system being invaded by malicious data; N_i represents the number of samples in the data set; $b_t(i)$ represents the total number of samples in the i data currently running. To extract the characteristic quantities of the security performance of the enterprise cluster intelligent manufacturing information management system, the following calculations are required:

$$G_{m,n} = \begin{bmatrix} C_r^b(q_{k+1}) & 0 \\ 0 & C_r^b(q_{k+1}) \end{bmatrix} \begin{bmatrix} r_a \\ r_m \end{bmatrix} + \begin{bmatrix} v_{k+1}^a \\ v_{k+1}^m \end{bmatrix} \tag{3}$$

In the formula, $C_r^b(q_{k+1})$ represents the serial probability value of the enterprise cluster intelligent manufacturing information management system based on wireless communication technology being illegally invaded; q_{k+1} represents the matching coefficient of the security performance of the enterprise cluster intelligent manufacturing information management system; in the above formula, it will usually be running The module and the influence of non-networked data are divided into 2*2 sections, and v_{k+1}^a and v_{k+1}^m are expressed as the coefficient components of the dynamic characteristics of the network. According to the above calculation formula, it is possible to obtain a schematic diagram of the evaluation results of the security performance of the wireless connection terminal data and local data during the process of networking in the enterprise cluster intelligent manufacturing information management system, as the number of data runs increases.

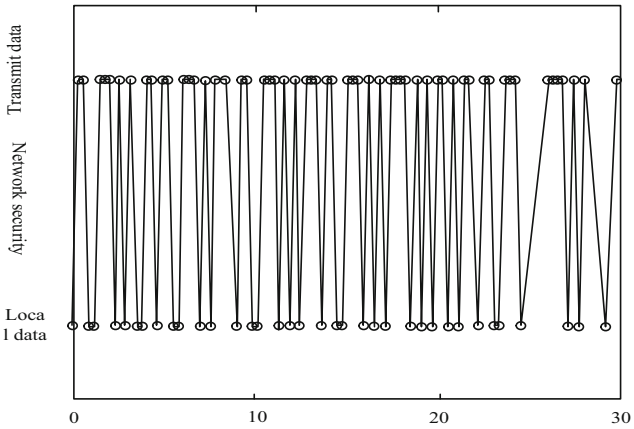

Fig. 4. Data security performance evaluation results

As shown in Fig. 4, with the increase in the number of data operations, the network security of the enterprise cluster intelligent manufacturing information management system fluctuates to a certain extent. Compared with the data at the wireless transmission end, the local data is safer. But in general, before the number of data runs does not exceed 25 groups, the risk is still within the range that can be borne. Therefore, the same user needs to pay attention to the simultaneous use of data not exceeding 25 when using the enterprise cluster intelligent manufacturing information management system. Group, otherwise it is easy to cause network security accidents.

5 Conclusion

In the above, an enterprise cluster intelligent manufacturing information management system based on wireless communication technology is designed, and the function test of the system in the experimental link proves that the software design has complete functions, friendly man-machine interface, and simple use. The operation process is safe and reliable, the use effect is good, and it has good cross-platform security, and basically achieves the expected goal. However, due to limited time and energy, some of the design functions of this system have not been perfected. This will continue to be improved in the later stage. In addition, the interface needs to be further beautified to meet the needs of employees in different departments.

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