Intelligent Service Scheduling Decision Technology under Artificial Intelligence Technology

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Abstract: The intelligent production line is a new intelligent production line resource formed by highly integrating modern sensor technology, communication technology, information technology, computer technology and control technology on the large physical real basis of the existing production line. It can finish data acquisition, information processing, dynamic virtual reconfiguration of variable batch production line, embedded algorithm, algorithm optimize the management of the production line manufacturing field, change the dynamic virtual reorganization of the mass production line, and become the choice of the development direction of the next generation of new production lines for mankind. Scheduling is the nerve center of the production line virtual reorganization system. The traditional main auxiliary decision-making tool management system can no longer fully meet the requirements of production line operation monitoring in the new environment, so the construction of an intelligent scheduling system is also one of the important contents of the construction of the production line virtual reorganization. Based on this, this article explores and researches intelligent service scheduling decision-making technology under artificial intelligence.
technology. The research topic of this article is intelligent scheduling of production lines, so this article first analyzes the current research status of intelligent service scheduling and decision support systems; then conducts research based on Agent decision support systems, and analyzes the framework and characteristics of decision support systems. Realizes the intelligent production line scheduling DSS system; then this paper designs the system's scheduling model with stochastic disturbance, system database and system fault diagnosis function, and realizes an intelligent service scheduling decision support system based on multi-agent technology. Finally, this article tests the data transmission speed and fault diagnosis function of the system. The test results show that the system is relatively fast in data transmission speed and the fault diagnosis function is also very reliable.

1. Introduction

Intelligent production lines have incomparable advantages that are different from traditional production lines. Therefore, once the concept of intelligent production line was put forward, it received widespread attention, and government departments, factories and enterprises, electrical equipment manufacturers, and information technology industry manufacturers also responded. In the face of frequent changed type and complex disturbance, the scale of production line continues to expand, the number of dispatchers is increasing, the equipment managed is growing rapidly, and the workload of the dispatching department is also increasing [1]. The traditional production line system scheduling is gradually unable to meet the requirements of the development of modern production line systems, so the concept of intelligent production line scheduling (hereinafter referred to as smart scheduling) has gradually formed and received extensive attention. Compared with traditional production line scheduling, it has the following functions: the sensitization of information perception and the automation of information collection; the intelligence of information screening and the scientificization of information memory; the accuracy of information prediction and the coordination of prediction results and decision-making models efficient modeling; globalization of optimization performance and agility of optimization solutions, as well as visualization of the calculation process and visibility of results, are important features that traditional production line scheduling cannot match [2]. Under current network conditions, intelligent scheduling ensures the reliable operation of production line transmission with complex production lines as the backbone, and is coordinated by all network levels. Under the condition of intelligent production line, it can monitor the production line, predict the status of the production line, minimize risks and perform real-time network monitoring.

Decision support system is developed on the basis of traditional management information system theory and applied in many different fields. Its ideas and technologies are both a new branch of information system development, and it is also the fastest-growing branch at present. The role of the decision support system is to support rather than replace the decision maker in the decision-making and decision-making process [3]. The purpose is to improve the decision-making effect of decision-makers, and improve the quality and efficiency of decision-making. Analyze, compare and judge through human-computer interaction, and provide necessary support for correct decision-making. The decision support system is an advanced information management system developed based on the management information system. In recent years, decision support systems have produced a series of new concepts, viewpoints and structures in the depth and breadth of research. Theories and application results have continued to emerge, which has greatly promoted the development of computer technology and artificial intelligence technology [4]. At present, the research on decision support system mainly has the following important aspects: First, the basic concept and connotation and system structure of decision support system are the key content of early research work. The second is the branch research extended by the decision support system, which is closely related to other disciplines and technologies, resulting in new research fields and expanding the functions of the decision support system. The third is to study and develop a series of decision support systems to support higher-level decision makers based on the characteristics of decision-making subjects.

Chinese scholar Li Changqi and others pointed out that with the continuous expansion of the scale
of production lines and the rapid increase in the amount of dispatching information, the study of efficient and intelligent dispatching systems is of great significance to the safe and stable operation of production lines. The traditional decision support system used by the production line in the past has a series of problems such as low scheduling flexibility, and it has been unable to meet the scheduling needs of the current production line. In order to solve the above problems, a multi-agent-based intelligent production line scheduling system is proposed, which is combined with the current decision support system to improve the efficiency and flexibility of production line scheduling, and realize the intelligent monitoring of production lines and dynamic prevention. Control, emergency dispatch plan optimization and other purposes [5]. Zhao Jinquan and others combed the application of the new generation of artificial intelligence technology in production line load and new energy prediction, fault diagnosis, online stability evaluation frequency, production line optimization control and production line operation mode formulation and other scheduling operation scenarios, and carried out the analysis and review summarized the existing problems in existing research, and pointed out that the application of artificial intelligence technology should be problem-oriented, scenario-based, and application-oriented [6]. Wu Haiwei and others proposed an algorithm for multiple types of controllable electrical appliances based on genetic algorithm. They defined the load scheduling problem as a cost minimization problem and solved it with genetic algorithm. Combined with the production line big data obtained from the enterprise, the production line demand of the enterprise was measured. Planning reduces the cost of the enterprise, thereby avoiding the waste of production line resources and improving the work efficiency of the production line. The algorithm has good feasibility and is easy to implement in actual operation [7].

2. Agent-based Decision Support System

2.1 Characteristics of Decision Support System Framework
The design and selection of the software framework is critical to the performance of the entire system. The software framework will have a greater impact on the system’s portability, changeability, and integration. When the scale of the software system is small, the performance requirements can be achieved by programming or debugging the program. With the continuous expansion of the scale of the software system, the performance of the software system will be more determined by the software system structure and function division. It is no longer the selected algorithm and data structure [8]. Therefore, these measures are difficult to meet actual needs. Since the decision support system is a system with constantly changing requirements, the changeability and integration of the system is very important in terms of its performance. Changeability refers to the change of a single component, the change of multiple components, and the change of the entire architecture. The purpose of the change is not to expand the components as much as possible, and the larger the system architecture the better, but to make the cooperation of the various parts of the system more coordinated and complete, so the changeability is expressed as updating some functions without affecting the work of other components. [9]. The changes mainly include the improvement of decision analysis functions and the expansion, change and deletion of certain functions. The integrability means that some parts of the system can not only work independently but also cooperate with other parts. The integration of the system depends on the complexity of each part of the system, the interaction mechanism of each part, and the clarity of function division.

2.2 Agent-based Decision Support System Framework
The framework structure of the agent-based decision support system can divide the agent into interface agent, task agent and information agent according to the functional characteristics of the agent. The decision-making goals can be achieved through the cooperation of these three types of agents. The interface agent is mainly responsible for collecting relevant information for decision makers or displaying the processing results of relevant information for decision makers, and reminding decision makers that they need to provide additional information or confirmation information during this
decision analysis process. The task agent in the system accepts the decision analysis task proposed by the decision maker through the interface agent, translates the task and then extracts the core problem to be solved and customizes the decision-making problem plan [10]. The decomposition plan executes the plan through the cooperation of the task agent and the information agent, and synthesizes the result. The system structure separates and abstracts Agents according to their respective functional characteristics. What needs to be explained is that this will inevitably reduce the changeability of the system. This is because this separation will cause complex interactions between the Agents, especially between the Information Agent and the Task Agent. At the same time, there may also be information conflicts between the Information Agents. Therefore, a conflict resolution solution is required within the Task Agent. Reduce the changeability of the system [11]. This article divides Agents according to different sub-decision-making system goals. Each agent will deal with a department's decision-making goal, realize the tasks of a department or several departments with common decision-making goals, and analyze subject-oriented data. The decision support system is just a multi-agent system composed of multiple such Agents. In addition, the cooperation between Agents can support higher decision-making goals. This division method can significantly reduce the communication between Agents and strengthen the connection between the various parts of the Agent.

2.3. Realization of Intelligent Production Line Scheduling DSS

The fundamental task of the decision support system is to analyze and calculate based on the real-time data collected from the bottom layer and the parameter information of the production line system equipment to evaluate the current operating status of the production line system. In the normal state, the system is in a safe and economical state, and then it is reported later. In the alert state, the dispatcher is notified of the weak link of the system, so as to "prevent problems before they occur." In the fault state, the decision support system diagnoses the fault based on the results of the underlying calculations, and obtains a solution, and at the same time issues a fault operation ticket. Use the real-time data collected by SCADA and the data collected by the fault information system to calculate, evaluate the operation status of the production line system, and analyze the safety and economy of the system to obtain an analysis report. The steady-state analysis process first conducts the network topology. Through the network topology, the dispatcher can grasp the operating conditions of the equipment in the system, and then estimate the state of the system to obtain a state estimation report, and then perform power flow calculation, reactive power optimization and report, and finally carry out safety analysis to get analysis decision [12]. Traditional Web publishing cannot actively pop up information. Only the staff can open the browser to view the operation of the system, and some people with a lot of work may ignore some important information about the operation of the production line. Therefore, we need to make Web publishing intelligent, not only to proactively prompt important information, but also to set the priority level according to the importance of the information, which can improve the coordination ability between various production lines and the response speed to event processing.

3. Smart Grid Dispatching Decision Support System Based on Multi-Agent Technology

3.1. Design of Visualization Module

An important part of the intelligent production line scheduling decision support system is to design a new type of scheduling decision support system that can mine the data after DSS analysis and processing. The content displayed on the human-machine interface of the intelligent production line scheduling DSS includes: display the data that needs to be displayed from the bottom layer; the running state after the processing of each module can generate two-dimensional and three-dimensional images or animations, which can be expanded from different levels. You can also select the part of the graph you are interested in and expand it further. The menu bar provides commonly used tools for system management, mainly including level operation, graphics perspective, refresh, theme switching, sub-theme information, control operation, remote assistance, etc. The toolbar is used to perform image
shortcut operations. A column chart can be used to indicate overall system security, arranged in order from bottom to top, and the corresponding colors are from light to dark. The darker the color, the more unsafe. The early warning list displays various early warning and alarm information synthesized by the current bottom layer, sorted by severity level, and displays one or several solutions provided by DSS. Double-click the information in the alert list to display its detailed information, if necessary, it can also be converted into an image or animation mode. The topic list displays all the topics of the system, their information and corresponding operations. The user can load or uninstall the corresponding theme through the system menu. Each theme has several attributes that are reflected through graphics or animation. The main display area is divided into several functional areas. The upper left area displays the name of the current theme. The upper right area displays the specific operation content of the graph. The formulas used in the design process of the visualization module are:

$$T_f^n = T_f^0 T_1 T_2 \ldots T_{n-1}$$  \hspace{1cm} (1)

3.2 System Database
The database is the place where the system uniformly stores all kinds of information, so we must first understand the characteristics of the database, and then further analyze the principle and application of the real-time database. The data that the dispatching system manages, maintains, and shares is not only large, but the collected data is also effective in a short period of time. Therefore, maintaining data integrity and being able to analyze and process valid data in a short time is the focus of database analysis. In reality, the true reflection of the attributes of the periodic collection object has a strict time limit, that is, it corresponds to the sampling time, and it has a valid period, which is valid only from the end of sampling at this time to the beginning of sampling at the next time. Real-time data and other data are calculated by a certain method. It is also real-time and time-effective. Time-effectiveness is the same as that of real-time data. The effective period is from the end of this calculation to the beginning of the next calculation. These data are the solution goals of the system, and may also be the original data of a certain task. Since real-time database data read, write, query and other operations are all completed in memory, this requires a large amount of memory in the system, and the development of information technology just provides the basis for it. Compared with the traditional database using disk to operate data, the efficiency is much higher. Agent is reactive and will react to the environment according to certain rules. The behavior of the agent and the interaction between agents must be based on the knowledge base. The level of abstraction, representation and coverage of the knowledge base determine the level of the Agent’s intelligence level. The formulas used in the system database design process are:

$$A = \lambda (\frac{x_{n+1} - x_{n-1}}{y_{n+1} - y_{n-1}})$$  \hspace{1cm} (2)

3.3 Specific Analysis of Fault Diagnosis Based on Agent Model
When a fault occurs, the corresponding diagnostic agent registers with the upper Agent server. The registration is mainly attribute registration, including the occurrence time, location, type, and so on. After registration, the Agent server will automatically detect and update the current attributes of all diagnostic agents at regular intervals. During the diagnosis, the data processing module of the diagnosis knowledge agent screens the data and selects the data related to the diagnosis content. To ensure the goodness of the data, we clean the selected data, and finally store the processed data in the data storage of the diagnosis knowledge agent in. The diagnostic knowledge agent coordinates the request scheduler and other diagnostic knowledge agents to process problems, request information and content related diagnostic knowledge agents. This article defines these agents as acquaintance agents. According to the familiarity of the diagnosis content, acquaintance agents are divided into three categories, state acquaintance agents, ordinary acquaintance agents, and system acquaintance agents. These acquaintance agents arrange the priority of diagnosis according to the degree of conformity of the requesting agent to themselves, and incorporate the requesting agent into the corresponding small
group of acquaintance agents, and at the same time process the diagnosis agent with the highest priority. After the processing is completed, the result is fed back to the requesting agent, and the requesting agent continues to diagnose until the diagnosis process is completed. Then the system evaluates the diagnosis results and sends the credible evaluation results to the acquaintance agent as reference materials for future diagnosis, and then stores the updated resources of the acquaintance agent in the knowledge base. In this fault diagnosis model, the cooperation between acquaintance agents and the cooperation between acquaintance agents and requesting agents are very critical, and the team of acquaintance agents is large and needs to be gradually reduced in the process of multiple diagnosis until it reaches a suitable level.

4. System Test

4.1 System Data Transmission Speed Test

Table 1. System data transmission speed test

| Transmission speed | Number of times | Percentage |
|--------------------|----------------|------------|
| High speed         | 9              | 30%        |
| Faster speed       | 13             | 43.3%      |
| Average speed      | 6              | 20%        |
| Slower speed       | 2              | 6.7%       |

Figure 1. Test of system data transmission speed

According to Table 1 and Figure 1, we have conducted a total of 30 tests on the data transmission speed of the system, of which 9 times the transmission speed is very fast, accounting for 30%; 13 times the transmission speed is faster, accounting for 43.3%; There are 6 times that the transmission speed is average, accounting for 20%; there are 2 times the transmission speed is slower, accounting for 6.7%. Analyze the data results. In the data transmission speed test of the system, 73.3% of the data transmission speed is faster or higher, and 28.7% of the data transmission speed is normal and slow due to the instability of the network and the excessive data transmission capacity. Generally speaking, the intelligent production line scheduling decision support system designed in this paper is relatively fast in terms of data transmission speed.

4.2 System Fault Diagnosis Function Test

Table 2. Testing of system fault diagnosis function

| Diagnose the situation | Number of times | Percentage |
|------------------------|----------------|------------|
| Successful diagnosis   | 25             | 83.3%      |
| Error diagnosis        | 1              | 3.3%       |
| Unable to diagnose     | 4              | 13.3%      |
According to Table 2 and Figure 2, a total of 30 tests were performed on the system fault diagnosis function, of which 25 were successfully diagnosed, accounting for 83.3%; 4 were not diagnosed, accounting for 13.3%; there was 1 error diagnosis, accounting for 3.3%. Analyzing the results, it is found that the system's failure to diagnose is caused by network stalls, and the system's first error diagnosis is caused by the data input error of the experimenter. Excluding the influence of network and human factors, the diagnostic function of the intelligent production line scheduling decision support system designed in this paper is relatively reliable.

5. Conclusions
With the continuous expansion of the scale of the production line system, the system structure and operation mode are becoming more and more complex, this puts forward higher requirements on the reliability and economy of the production line system operation, and makes dispatchers face new challenges. At the same time, computer information technology and artificial intelligence technology are also constantly developing, and they are increasingly being used in the field of enterprise production lines. For the dispatch system, the application of data acquisition technology, computer technology and communication technology, rich and accurate data can be transmitted to the dispatch control center of the production line in the shortest time. On this basis, a "intelligent production line dispatching decision support system" with complete functions, easy to use, and online autonomous and coordinated operation is constructed, which improves the reliability and flexibility of the dispatching automation system, and becomes the development of enterprise production line dispatching automation new direction.

Project fund
This article is one of the phased results of the national key research and development project "Data Intelligence Driven Real-time Operation Optimization Technology Research" (2020YFB1712202).

This article is one of the phased achievements of the Jilin Province Science and Technology Development Project "Research on the Key Technology of Intelligent Grinding and Polishing of Complex Blade Robot Force Positions" (20190302122GX).

This article is one of the phased achievements of the scientific research planning project of the Jilin Provincial Department of Education, "Research on the Force Position Parallel Grinding and Polishing Machining Mechanism and Motion Planning of Complex Blade Robots" (JJKH20200747KJ).

This article is one of the phased achievements of the China Postdoctoral Science Foundation project "Aeronautical Blade Robot Force Position Parallel Grinding and Polishing Processing Mechanism and Motion Planning" (2021M692457).
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