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Retraction

Retracted: Optimization of Distribution Automation System Based on Artificial Intelligence Wireless Network Technology

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] W. Tian, X. Meng, J. Wang, and H. Yan, "Optimization of Distribution Automation System Based on Artificial Intelligence Wireless Network Technology," *Journal of Sensors*, vol. 2022, Article ID 1646667, 8 pages, 2022.

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Research Article

Optimization of Distribution Automation System Based on Artificial Intelligence Wireless Network Technology

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In order to further improve the automation setting of distribution system, this paper proposes an optimization research of distribution automation system based on artificial intelligence wireless network technology. This method uses artificial intelligence wireless network technology to optimize the automation of distribution system and improve the automation ability of distribution system. The experimental results show that when the number of iterations in the training process reaches 338, the mean square error is 0.001. *Conclusion*. The optimization research method of distribution automation system based on artificial intelligence wireless network technology can more effectively improve the automation level of distribution system.

1. Introduction

Distribution automation is an important means to improve the reliability of power supply, and it is also an important part of smart grid. From the end of the twentieth century to the beginning of the twenty-first century, there was also an upsurge of pilot construction of distribution automation. However, many early built distribution automation systems did not play their due role, mainly due to two reasons: technology and management. Technical problems include immature technology in the early stage, backward communication means, and defects in the early distribution network. The management problems mainly include the lack of standards and norms to guide the planning, design, construction, operation and maintenance of distribution automation, and the pursuit of one-step "large and comprehensive" results in excessive planning and insufficient later operation and maintenance.

After nearly 10 years of exploration and practice, the distribution automation technology has matured, and the communication technology has made revolutionary progress. Power enterprises have formulated a series of standards and specifications for the design, construction, operation, and maintenance of distribution automation. With the construction of smart grid, distribution automation system has ushered in a new round of construction climax. The State Grid Corporation of China reviewed the distribution automation project plan in three batches, completed the practical acceptance of all 4 urban distribution automation pilot projects in the first batch, and completed the project acceptance of all 19 urban distribution automation pilot projects in the second batch. This round of distribution automation system has made essential progress over the previous round in terms of automation technology, testing technology, project management, and practicality.

Industrial wireless technology is a new wireless communication technology for information interaction between devices. It is suitable for use in harsh industrial field environment. It has the characteristics of strong anti-interference ability, low-energy consumption, and good real-time communication. It is a special kind of sensor network [1]. At present, the widely used industrial wireless technologies include wireless LAN, Bluetooth, and ZigBee. Through the research of Bluetooth network communication protocol, an embedded network node with ARM9 processor and Bluetooth adapter as the core is designed, which has the functions of analog-to-digital conversion and switching input and output. In the embedded Linux system on ARM9 platform, the device driver is written, the

BlueZ protocol stack is transplanted, and the communication program is developed on the protocol stack to realize the functions of searching devices, discovering services, establishing connections, and sending and receiving data. Therefore, artificial intelligence wireless network technology is used to further optimize the distribution automation system, so as to better carry out the distribution operation and achieve the effect of high automation.

2. Literature Review

With the construction of smart grid and the development of communication technology, distribution automation technology, as an important part of smart grid, it has made great progress and has made many constructive progress in distribution automation master station, terminal, communication network, and testing technology, which has laid a solid foundation for the practical application of distribution automation system. Compared with the previous round of distribution automation research, at present, the greatest progress of the distribution automation master station lies in two aspects: the establishment of an information interaction bus in line with IEC61968 standard and the unified standard information interaction with other information systems. It has a complete and practical fault handling application module.

In practical application, the distribution automation system needs to interact with the upper level dispatching automation, production management system, power grid geographic information system, marketing management information system, and 95598. In the last round of distribution automation construction, the private protocol of "point-to-point" as shown in Figure 1 is used to realize the interconnection of distribution automation system and other application systems. Not only many interfaces need to be maintained, but also because the private protocol adopted is not standard, the interchangeability is poor, and the expansion is difficult. In the figure, EMC is an energy management system.

In the construction of smart grid, the distribution automation system adopts the information interaction bus conforming to IEC61968 standard according to the principle of "unique source data and global information sharing" and completes the information exchange and service sharing between the distribution automation system and other application systems through the bus mode based on message mechanism, as shown in Figure 2. It not only greatly reduces the number of interfaces, but also has the advantages of standardization, strong interchangeability and easy expansion. On the premise of meeting the safety protection regulations of power secondary system, the information interaction bus has the ability to realize information interaction through the forward/reverse physical isolation device through the production control area and the management information area. Follow IEC61968 standard and adopt service-oriented architecture (SOA) to realize the publishing and subscription of relevant models, graphics, and data [2].

The concept of cognitive radio was first proposed because it has good perception, reasoning, and learning ability [3]. These capabilities enable cognitive radio technology to dynamically adjust the spectrum usage to further improve the spectrum efficiency. This undoubtedly alleviates the current shortage of spectrum resources. However, with the further development of communication technology, wireless networks that introduce the concept of cognition are changing in the direction of complexity, isomerization, and dynamics. Some traditional network management methods are no longer suitable for the complex situation faced by the current network. Therefore, in order to effectively manage the network to meet these challenges, reconfiguration technology is introduced into cognitive wireless networks. Reconfiguration technology maintains the performance of cognitive wireless networks by changing a series of wireless parameters and adjusting the corresponding network behavior. This maintenance can not only ensure the network performance, but also take into account the needs of users when the environment and system requirements change dynamically. The reconfiguration technology applied to cognitive wireless networks can provide a more flexible and adaptive network management method for the network, but correspondingly, the implementation of reconfiguration technology in cognitive networks also needs to rely on the unique perception ability, prediction ability, and learning ability of cognitive networks. The two complement each other and further improve the system performance. The decision-making of reconfiguration is the key part of the realization of reconfiguration technology. The reconfiguration decision first obtains the network parameters that need to be changed by analyzing the factors that affect the performance and then deploys the reconfiguration through calculation to map these changes to the actual network structure. This not only ensures that the system can adapt to the dynamic environment, but also saves the time of system operation.

With the mutual penetration and combination of computer network technology, wireless technology, and intelligent sensor technology, a new concept of networked intelligent sensor based on wireless technology has emerged. This networked intelligent sensor based on wireless technology enables the data of industrial sites to be directly transmitted, published, and shared on the network through wireless links. Wireless communication technology can provide high bandwidth wireless data links and flexible network topology for the communication between various intelligent field devices, mobile robots and various automation devices in the factory environment, effectively make up for the shortcomings of wired networks in some special environments, and further improve the communication performance of industrial control networks. Therefore, compared with other application fields (military, commercial, medical, etc.), wireless sensor networks are very suitable for industrial applications. The concept of micro sensing and the wireless connection of nodes make it of high theoretical and practical significance in the field of industrial measurement and control [4].

According to the above research, this paper proposes a method of distribution automation system optimization research based on artificial intelligence wireless network technology. This method uses wireless network technology to optimize the distribution system automation, and further improves the wireless network technology through reconfiguration decision, so that it

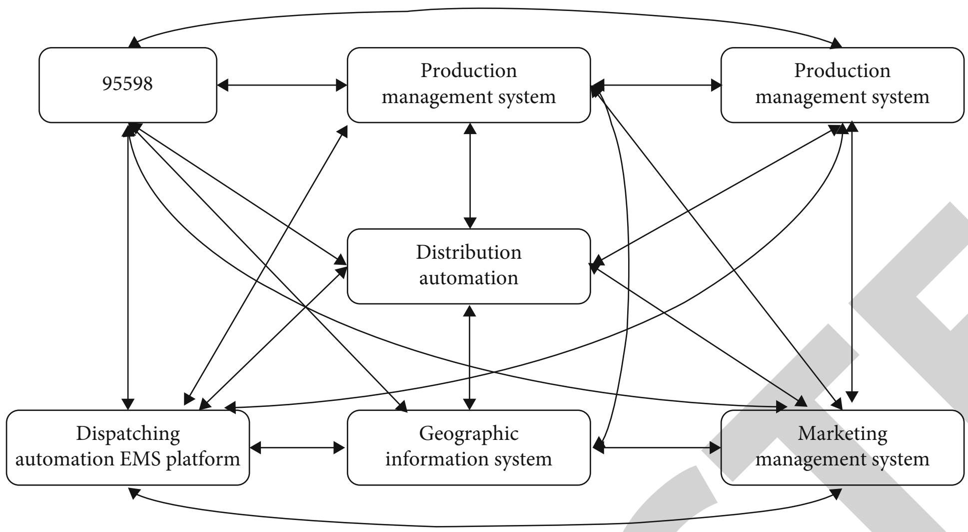

Figure 1: Interconnection between "point-to-point" systems.

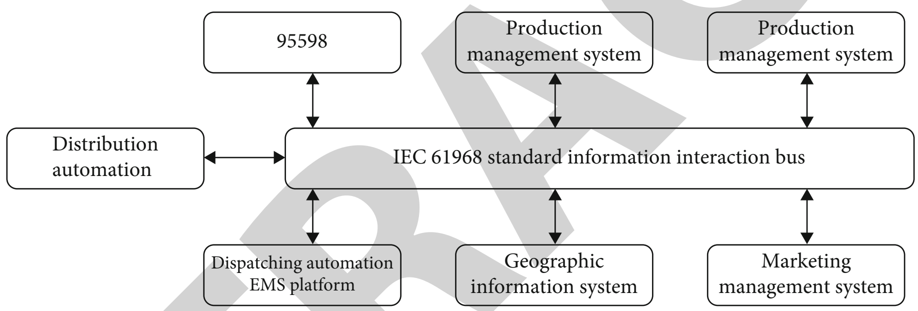

Figure 2: Interconnection between systems using information interaction bus conforming to IEC61968 standard.

can better improve the distribution automation system, so as to achieve the purpose of automation improvement.

3. Research Methods

3.1. Distribution Automation System

3.1.1. System Architecture. The power distribution automation system architecture of the super large data center is composed of two parts: the main workstation and the subworkstation [5]. The subworkstation is connected to the full end power equipment through RS485 bus, and the equipment is connected to the automatic control system network according to Modbus communication protocol, and uploaded to the main workstation. Based on the power data uploaded by the substation, the main workstation calculates and generates the optimal safe power supply path scheme and sends control commands to the power equipment through the subworkstation to transfer the power loss load to the safe power supply path. After the command is issued, the high-voltage switchgear executes the corresponding commands to complete the switching action based on the sampling unit, storage unit, calculation unit, comparison unit, and control unit.

3.1.2. AI Safe Power Supply Path Search Algorithm. The algorithm equates the network topology relationship to the interconnection matrix that can be recognized by the computer. When a fault occurs, identify and mark the fault area, bypass the fault area through intelligent search, and distribute the load of the fault area to other power sources [6, 7]. Based on the above principles, the search algorithm can accurately convert the electrification of the power system under different fault conditions into a mathematical model in real time and give it to the computer for overall calculation and scheduling, and then, the scheme generated by the calculation results can be dispatched by the terminal high-voltage switch through the way of communication commands, so as to meet the disaster tolerance requirements of the power system in the super large data center. After using the AI algorithm of safe power supply path, the power equipment in the whole park can be dispatched as a whole, so as to better tap the potential of equipment capacity and shorten the return period of investment. The secure path search algorithm is shown in Figure 3.

3.1.3. Load Classification Mechanism. Although the data center business is absolutely not allowed to be interrupted, different equipment and business types still have different importance, such as centralized cooling unit and core business are relatively

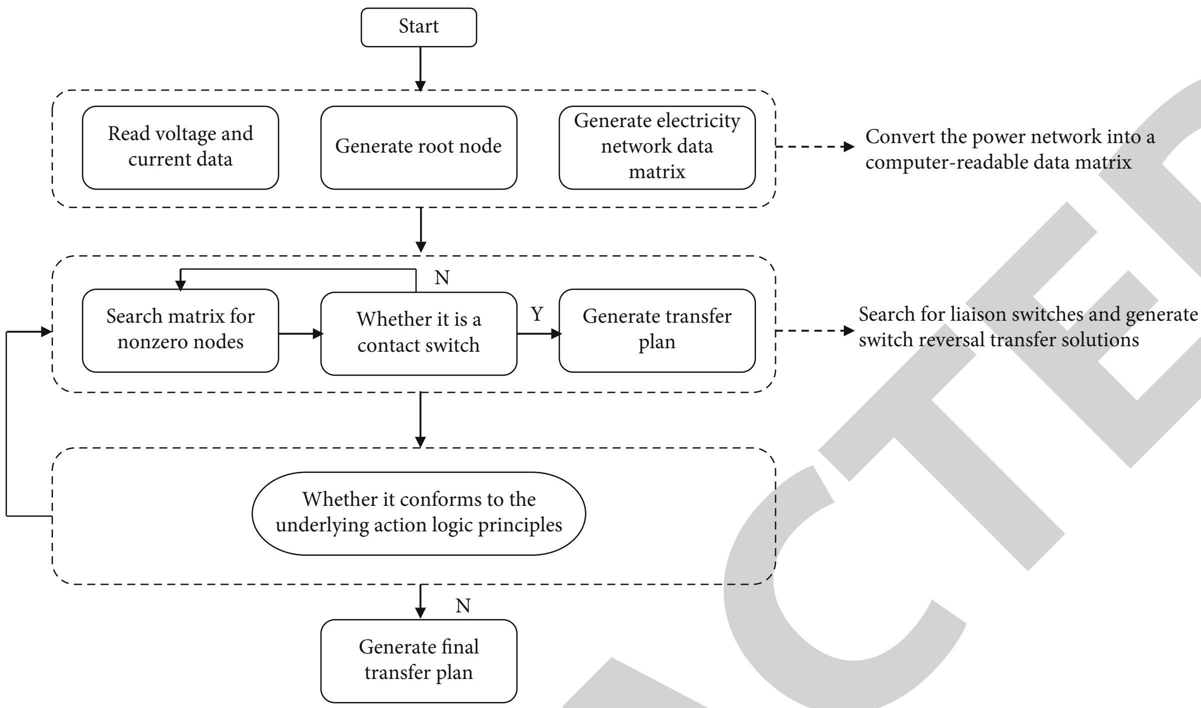

Figure 3: Flow chart of secure path search algorithm.

important. The priority of the system is considered from the following aspects:

(1) Priority for important power equipment: The power supply needs to be restored 4 minutes after the power failure of the centralized refrigeration station to ensure the continuity of cooling in the machine room. (2) Transmission/network export priority: After the power interruption of the transmission/network machine room in the park, a "data island" will be formed, which will disconnect the connection with the external network, and the guarantee level is also higher than that of the ordinary data machine room. (3) Priority of important business: The data room that hosts multiple regions and users also has a higher guarantee level than other ordinary data rooms.

In case of power supply interruption, the distribution automation system gives priority to the use of mains power to restore power supply to important loads. In case of insufficient load, the distribution automation system will immediately send the oil engine starting signal to the oil engine paralleling cabinet. After starting the minimum paralleling number that meets the remaining load, control the oil engine feeder cabinet to switch on, and put the generator into power supply. In this way, the safety of power supply can be guaranteed in the shortest time.

Taking a data center as an example, the differences between using ATS, standby automatic switching system, and using distribution automation system are compared. The action logic of ATS and standby automatic switching system commonly used in the traditional power industry is to start and put the oil engine into operation immediately when the load power supply loses power in two ways. If the power supply structure is multichannel incoming line, the oil engine will still be started when the municipal capacitance is sufficient [8, 9]. The distribution automation system will give priority to judge whether the municipal capacitance can meet the requirements of power loss load. If it meets the requirements, the control switch will directly input the municipal power, and on this basis, the load grading guarantee function is realized.

3.2. Framework Basis of Reconstruction Decision

3.2.1. System Architecture. In order to reflect the unique perception process, reasoning process, learning process, decision process, and action process in cognitive wireless networks, the proposed reconfiguration decision architecture includes several modules: reasoning engine, learning engine, rule engine, decision engine, and action engine. Figure 4 shows the interconnection of each module.

In order to make reconstruction decisions, we must first know the complete external environment information and wireless control parameter information [10, 11]. This information is collected by sensing technology and stored in the wireless environment mapping (REM) database in a form that the system can understand. REM database classifies and stores these data in order to provide a data basis for reconstruction decisions and dynamically updates them throughout the operation process.

The rule engine deduces the interaction relationship between wireless parameters and system performance based on the comprehensive consideration of environmental information, wireless parameter, information and relevant policy rule information and inputs these associated information into the database. The reasoning model with predictive ability established based on these correlation information can adaptively select the appropriate configuration in the dynamic environment to meet the system performance requirements [12].

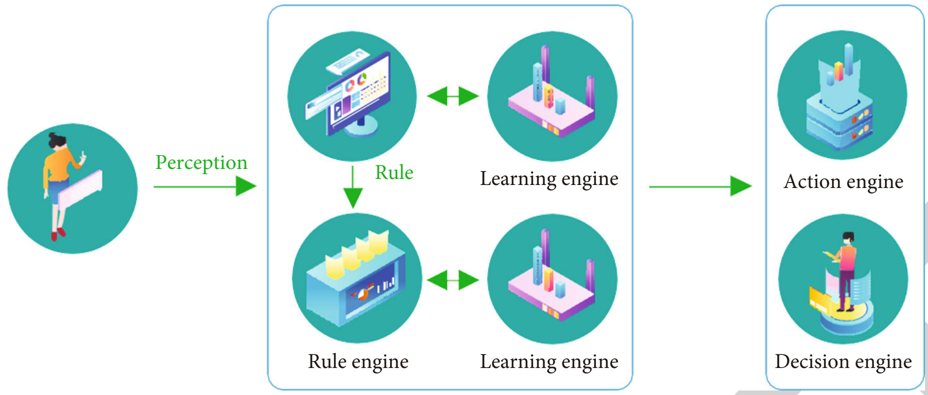

Figure 4: Architecture basis of reconstruction decision.

In order to realize the initiative of cognitive wireless network and save reconstruction time, the inference engine will first establish a priori analysis model with the help of a series of rules obtained by the rule engine and the expert system algorithm in artificial intelligence technology. This model can directly deduce the possible cognitive network reconstruction methods when facing the simple network structure. The learning engine optimizes the results produced by the reasoning engine by learning experience from historical information and environmental information and then stores the optimization results in the database and serves for the next decision-making. Learning engine is mainly involved in the decision-making of reconstruction in complex network structure, in order to make up for some shortcomings of reasoning engine in the face of complex data processing. The decision engine maps the calculation results of the previous reasoning engine and learning engine into reconstructed decisions and passes them to the action engine. The action engine mobilizes the system to change parameters and adjust wireless behavior according to the decisions.

3.2.2. Reconstruction Decision Algorithm Based on Artificial Intelligence Technology. In order to better use the reconfiguration decision algorithm to further improve the wireless network technology, artificial intelligence technology is introduced in this paper. Reasoning engine and learning engine are the main parts to complete the reconstruction decision in cognitive network [13]. The inference engine manages the system behavior and configuration by mapping the existing knowledge to the current environmental conditions. The learning engine optimizes the operation in the cognitive network by learning historical information and experience. In addition, the learning engine and the reasoning engine interact and promote each other: The learning process enriches the knowledge to be used in the reasoning process and optimizes the output of the reasoning engine. The inference engine provides more training data and instances for training and initializing the new learning engine.

In terms of the subtle relationship between learning and reasoning, artificial neural network (realizing the learning process) combined with rule-based expert system (realizing the reasoning process) can realize a complete reasoning learning process and complete the reconstruction decision with the system requirements as the goal [14, 15]. Firstly, the rule expert system infers based on the rules derived from the rule engine. At the same time, these rules are used as training data input based on neural network learning engine. In this way, when the new environmental information is input into the trained learning engine, the learning engine can produce a series of new rules. With the help of these new rules, the reasoning engine can optimize the reconfiguration decision. The working condition of the reasoning engine in the reconstruction decision-making process is shown in Figure 5.

3.2.3. Reconstruction Decision Algorithm Combining Reasoning and Learning. The advantages of learning engine are reflected in three aspects [16]. Firstly, the learning engine can learn the environment information to generate new rules and update the rule storage in the database in real time. Secondly, fuzzy search can be applied to approximate reasoning in the learning process, which improves the reliability of reasoning. Finally, the learning engine can extract the objective function and optimize the reasoning results by optimizing the objective function.

3.3. Steps of Reconstructing Decision Algorithm. Step 1 Initialization.

Initialize the rule space and map the rules to the three-layer artificial neural network model. The preceding part of the rule (wireless parameter part) is mapped to layer 1 (input layer). The latter part (describing the system performance part) maps to the third layer (output layer). The hidden layer in the middle represents the mapping relationship between the input layer and the output layer.

Step 2 Set the activation function, and the function expression is shown in

$$y_k(p) = \mathrm{sigmoid}\left[\sum_{i=1}^{n} x_i(p) \times \omega_{ik}(p)\right]. \quad (1)$$

Step 3 Use back propagation algorithm for training.

Step 4 Iteration.

Step 5 Apply the trained neural network model for reasoning and decision-making [17].

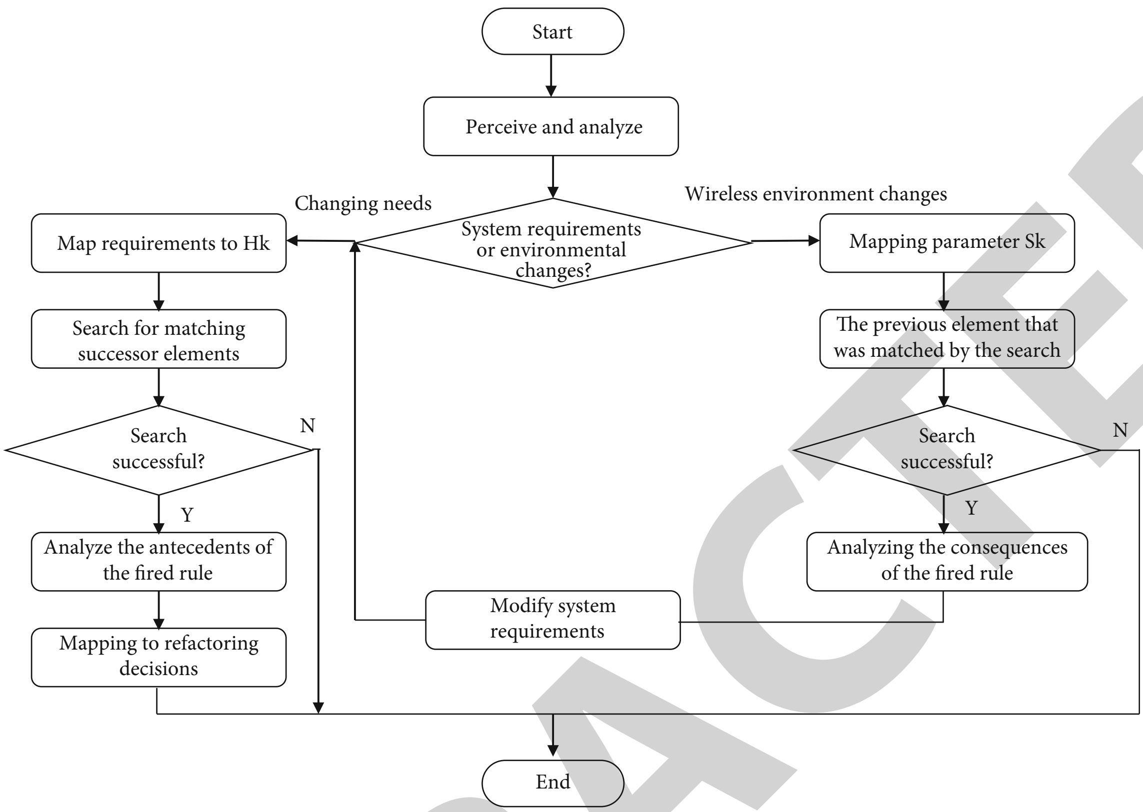

Figure 5: Workflow of reasoning engine in the process of reconstruction decision-making.

Figure 6: Error changes during training.

4. Results and Analysis

In the simulation process, the four parameters of data transmission rate (DR), transmission power (TP), frame length (FS), and noise level (n) represent wireless parameters, and the throughput (T) of the system is taken as the measurement parameter of system performance [18]. The simulation shows the influence degree of wireless parameters on system performance in three cases: when using neural network combined with rule expert system algorithm to make reconstruction decision, when using the worst configuration, and when using the best configuration, it refers to the parameters that can produce the best or worst system performance. The algorithm simulation of neural network combined with rule expert system starts from the most conservative configuration (equivalent to the worst configuration). Then, it adaptively adjusts parameters to meet the needs of system performance [19].

Input the parameters (data transmission rate, transmission power, frame length, and noise) that need to be reconstructed into the trained neural network system, and adjust them with the reconstruction decision algorithm based on the changes of system performance [20]. The setting scenario is as follows: the simulation duration is 180 s; the transmission rate is maintained at 10 mbit/s from 20 s to 90 s, 13 mbit/s from 90 s to 130 s, and 3 mbit/s from 130 s to 180 s; and the noise is 0.81 dbm from 40 s to 70 s, 10.3 dbm from 70 s to 110 s, 8 dbm from 110 s to 150 s, and 3.2 dbm from 150 s to 180 s. In this process, as the environment changes, the reconstruction algorithm based on artificial intelligence will adjust to maximize the throughput through the parameter performance relationship obtained above. The error is shown in Figure 6.

It can be seen that the mean square error of the method used in this paper is 0.001 when the number of iterations in the training process reaches 338, indicating that the method used in this paper can effectively reduce the error.

5. Conclusion

This paper presents a method of distribution automation system optimization research based on artificial intelligence wireless network technology. This method combines the development prospect of wireless network technology in the current era of artificial intelligence, and applies it to the distribution automation system, so as to further optimize and improve the distribution automation system. The experimental results show that the mean square error of the method used in this paper is 0.001 when the number of iterations in the training process reaches 338. It shows that the method used in this paper can effectively reduce the error. It proves that the method used in this paper can effectively improve the automation of distribution system and make it more effective in distribution work.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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