Hindawi
Wireless Communications and Mobile Computing
Volume 2023, Article ID 7169006, 14 pages
https://doi.org/10.1155/2023/7169006

Research Article

Design and Optimization Method of Intelligent Interconnection Decision System Based on Blockchain Technology

Honghan Wu

Business School, Sichuan University, Sichuan Chengdu 610041, China

Correspondence should be addressed to Honghan Wu; wuhonghan@stu.scu.edu.cn

Received 7 July 2022; Revised 19 September 2022; Accepted 3 October 2022; Published 13 April 2023

Academic Editor: Hangjun Che

Blockchain, as the application of distributed computing and data storage, point-to-point transmission, encryption algorithm, consensus mechanism, and other technologies, has become an important hotspot of data technology in banks, securities, and other Internet enterprises. In view of the problems of delay and large throughput in the current intelligent interconnection system of block chain, this paper proposes an optimization method of intelligent interconnection of block chain technology, so as to improve the performance of the system. In this paper, firstly, the development of intelligent interconnection and the related concepts of intelligent interconnection system optimization are put forward. Then, the related algorithms of blockchain are proposed, including the consensus algorithm of blockchain and the throughput delay algorithm of blockchain. Finally, in the experimental part, the blockchain technology is deeply studied, and the advantages and internal structure of blockchain are clearly analyzed. Then, by comparing the consensus of blockchain to optimize intelligent interconnected system and comparing blockchain technology with ordinary technology to optimize intelligent interconnected system, it is concluded that blockchain plays a positive role in optimizing intelligent interconnected system and also promotes the optimization of intelligent system. Therefore, we should introduce the related technologies of blockchain into the optimization of intelligent interconnection system, and its blockchain technology analysis can make up for the shortcomings of intelligent interconnection system. It also shows that blockchain technology is suitable for many information research fields and plays an irreplaceable role. The blockchain system consists of six different hierarchies, mainly network data layer and blockchain consensus layer. The data layer mainly encrypts the data related to blockchain. The consensus layer recognizes the main algorithms of blockchain, which can encapsulate the network information nodes of blockchain. Therefore, when blockchain carries out relevant information analysis algorithms, it mainly relies on blockchain consensus algorithm. It is beneficial to analyze the complex information of the system and promote the optimal development of blockchain.

1. Introduction

Blockchain is an open and distributed data store that records transactions securely, permanently, and very efficiently. Like adopting more Internet technologies, the adoption of blockchain needs extensive coordination, and the author needs to describe the possible path of blockchain. Finally, it proposes how to optimize the intelligent interconnection system based on blockchain, so as to explain how the basic blockchain has a firm foothold and how the blockchain operates [1]. Blockchain is reliable and stable and can provide a new and cost-effective way to record transactions. It is proved that the longest chain of blockchain is a perfect equilibrium, and there is no bifurcation in the equilibrium path, which is in line with the pioneering viewpoint. However, we also clarify that blockchain game is a coordination game, which opens up space for multiple equilibria. We prove that there is branch balance among different blockchain chains, which leads to isolated blocks and may also lead to persistent divergence [2]. Blockchain-based applications are widely used in financial services, reputation systems, Internet of Things, and other fields. This paper gives a comprehensive overview of block chain technology. Firstly, the architecture of block chain is summarized, and the application of several typical consistency algorithms in different block chains is compared. In addition, the technical challenges and latest developments of packet chain

are briefly reviewed [3]. It is difficult to unify the standards and protocols related to interconnected systems widely. This paper summarizes an access control framework of interconnected systems based on blockchain technology. The first contribution of this paper is to provide a reference model for the framework proposed by = in the goal, model, architecture, and mechanism specification of interconnected systems. In order to realize the blockchain model, the blockchain is adapted into a decentralized access control manager. Finally, some limitations of blockchain research interconnected system are discussed, and a framework model for further optimizing interconnected system is proposed [4]. Blockchain has now been applied to various applications. The difference between blockchain and traditional distributed database is that it can run in a decentralized environment without relying on a trusted third party. Therefore, their core technology is consensus, how to reach an agreement among a group of nodes. For closed interconnected systems, distributed system community has conducted extensive research on this, but its application in open blockchain has revitalized this field and led to a large number of new designs. Finally, the blockchain consensus protocol is systematically and comprehensively studied to meet this challenge [5]. Interconnected systems are maturing from the initial stage and becoming a part of the future Internet. Although there are access management technologies in interconnected systems, they are all based on centralized models and introduce various new technical limitations for global management. The new architecture is a distributed interconnection system based on block chain technology. The architecture is supported by verification principle, and the specific scheme of interconnected logic system is analyzed. The results show that blockchain technology can be applied as an access management technology to the optimization of specific scalable interconnected systems [6]. An intelligent interconnection system is established, and a big data storage and intelligent platform based on the interconnection system is developed through intelligent interconnection data driving and mining. The data of each process and operation are compared and analyzed horizontally and vertically. The suggestion of intelligent interconnection system optimization is completed quickly and effectively and explores the integration of information technology, big data technology, Internet technology, and interconnected intelligent system technology [7]. Heterogeneous networks in space, air, ground, and sea have greatly promoted the development of interconnected systems. Therefore, it is very important to build a collaborative trust interconnection system to provide the accessibility and security of the ubiquitous interconnection system network. This paper proposes a trust evaluation framework between interconnected systems and Internet of Things devices, which is used to evaluate trust and select participants with low cost and high trust to improve data quality and achieve the effect of optimizing intelligent interconnected systems [8]. Today's society is undergoing great changes, and mankind is entering a great era. This paper puts forward the concept of intelligent interconnection system, which can cover the essence of contemporary change, and it demonstrates that intelligent interconnection will become the long-term development trend of society from the aspects of social needs, evolution of production methods, people's expectations, scientific and technological support, and development strategies of major economies. Suggestions are also put forward on the layout of the times transformation with intelligent interconnected system thinking [9]. With the development of the Internet era, people have studied the measurement and control technology optimized by interconnection technology with the theme of intelligent interconnection. In order to adapt to the optimization of interconnected systems, China's Internet system must follow the open concept and method. There are many ways to optimize intelligent interconnection systems, such as comprehensive development of practical applications, integration of interconnection majors, intelligent links, and more scientific and intelligent information detection technologies [10]. In order to optimize intelligent systems, we draw on our collective modeling experience and conduct extensive literature review to formalize the best practices for optimal modeling of intelligent interconnected systems. First, it clarifies a set of general principles that can be used to guide the analysis based on interconnected systems. To help implement the guiding principles, we outline and explain the key steps of optimizing interconnected systems in the modeling process, including how to formulate research problems, set up intelligent systems, consider appropriate model characteristics, conduct and improve analysis, quantify uncertainties, and exchange insights to optimize intelligent interconnected systems [11]. Intelligent interconnected system optimization has different applications and challenges. Among them, location information system is one of the key technologies to improve the optimization of intelligent interconnection system. However, it is a very difficult problem to optimize the best computing technology of intelligent interconnected systems. The purpose of this paper is to fill in the blank of choosing appropriate computing technology in the optimization of intelligent interconnected systems. The aim is to provide a better understanding of current research trends in this field of interconnected system optimization [12]. The recent trend of optimization of interconnected and shared systems begins to create a revolutionary paradigm shift for the optimization of interconnected systems in the next few years. In this paper, the optimization decision framework is proposed by considering the system optimization level, aiming at analyzing the challenges and opportunities of interconnected system optimization in recent years. And through the construction of interconnection network, the model of mathematical linear programming is used to compare and optimize the interconnection system [13]. Each interconnected system will take multiple readings to produce data streams, which will be stored in the system's mass memory and then transmitted to the system database through a specific protocol. In this paper, a model-based optimization method for interconnected systems is proposed from the aspects of system parameters, mass storage configuration, and system transmission bandwidth allocation [14]. Combined with the current situation of Internet, this paper analyzes the current situation of interconnection system optimization by using the method of correlation analysis. This paper systematically studies the development history of blockchain in China and analyzes the gradual improvement process based on the functions and characteristics of blockchain interconnection system. This paper discusses the characteristics and shortcomings of the financial blockchain interconnection

system in detail and analyzes the optimization scheme and decision-making of the intelligent interconnection system from the perspective of technological innovation [15].

2. Related Concepts of Intelligent Interconnected System Optimization

2.1. Development Characteristics of Intelligent Interconnection. We started from the traditional industrial age, experienced the information age and entered the intelligent network age. The traditional industrialization period is characterized by mass production as the economic and social development model. The network age is characterized by information revolution. We have entered the intelligent age of the Internet. Based on the Internet, abundant information, artificial intelligence, and technological revolution are the three major elements of comprehensive innovation and progress. During the era of intelligent Internet, we have undergone major changes in design innovation and upgrading. Innovative design is an important witness and innovation in today's era. In the future, we will formulate corresponding development strategies and important contents of implementation methods. The development of intelligent technology and economy is based on the revolution, information, and artificial intelligence technology in the network age. In the era of transformation from traditional industrialization to intelligence, automation and informationization have arrived. After years of accumulation, new production, lifestyle, innovation, connection, and promotion have undergone profound changes at the bottom, resulting in new industries, new business models, and technological progress, new technologies and technological progress. Intelligent Interconnect Point Manufacturing System is based on a large amount of data support, Internet, and intelligent computing technology. It is an intelligent system with mass customization and flexible production. Digital process, including high temperature data and intelligent production, serves the demand and quality of various new products and services. We then start using data and creating intelligent connections based on high data, artificial intelligence, and Internet connections. User connection, data conversion, and intelligent manufacturing interface are industrial, and real life is better. Intelligent interconnection era is the interface standard of communication protocol and data interaction. It combines cloud computing with data applications, collects and processes data, analyzes data, and imports images, scenes, software and hardware, and data, networks and widely used data. This also leads to the diversity of industrial design. Industrial design is mainly based on the changes of processing methods and machines and the relationship between people and objects and objects and objects. The characteristics of intelligent interconnection are shown in Figure 1. Intelligent interconnection mainly develops in three aspects, namely, performance development, function development, and architecture development. Among them, the development of intelligent interconnection is the key indicator of intelligent technology. The development direction of performance includes high speed, high precision, high efficiency, flexibility, process complexity, multiaxis, and real-time intelligence. The main trends of functional development are graphical user interface, visualization of scientific calculation, diversification of interpolation and compensation methods, built-in high-performance PLC, and application of multimedia technology. System development mainly includes integration, modularization, and networking.

Figure 1 may have the characteristics of intelligent interconnection, and the mode of production is personalized and customized, which is unique to the needs of users. Lifestyle is characterized by active choice and scene experience, which embodies intelligent selectivity and scene experience effect, and pays attention to life intelligence. The way of judgment is the dynamic change of innovation elements, which reflects the changing scenario application with the change of conditions. The connection mode is mainly data and information links, with intelligent selection effect. The driving mode is mainly manifested in the domestic demand of information, data and talents, which is the basis for achieving growth.

2.2. Application in the Age of Intelligent Interconnection. People-oriented intelligent design, cloud computing, large-scale data computing and interconnection, artificial intelligence as the core, ecological interconnection and intelligent computing as the core, the interconnection and integration of intelligence and artificial intelligence, and the integration of the Internet make virtual industrial design and manufacturing face a dilemma and change dramatically. The rapid development of industrial intelligence technology has brought new challenges to today's designers, and we must face up to the challenges of artificial intelligence design innovation. Among them, Ali and JD.COM intelligent robots have made great progress in user data analysis, image generation, and intelligent push based on user data. To realize big data artificial intelligence, computational intelligence is the expression of sensory abilities such as vision, hearing, and touch. Using advanced technologies such as speech recognition and pattern recognition, the physical world signals are mapped to the digital world through cameras, microphones, or other sensors, and then the information is moved to the memory and cognitive design level. In this process, interface design is very important. The collection of these data, a large amount of artificial intelligence data supports these computers. With the rapid development and application of cloud computing, the development of artificial intelligence can further promote the Internet. The development of robot and other application technologies, which adapt to the mechanization of intelligent human in ms and get rid of human intervention and control, is very important to the work in education, medical treatment, agriculture, industry, military affairs, logistics, space coordination, and other fields and is expected to provide the most direct service in the future intelligent health and robot production. This intelligent design and development network has great innovation space and needs a large number of designers. We often hear that blockade poses a threat to technology. Blockade interconnection technology is an indispensable intelligent interconnection in intelligent interconnection systems. Innovation often replicates complex problems, and feedforward protection can effectively solve the problems. When the engineer loads the optimization information into the intelligent integrated block design, others can directly load the response model. Obstacles to cooperation past goals can only be achieved by one person or a small team. In the future,

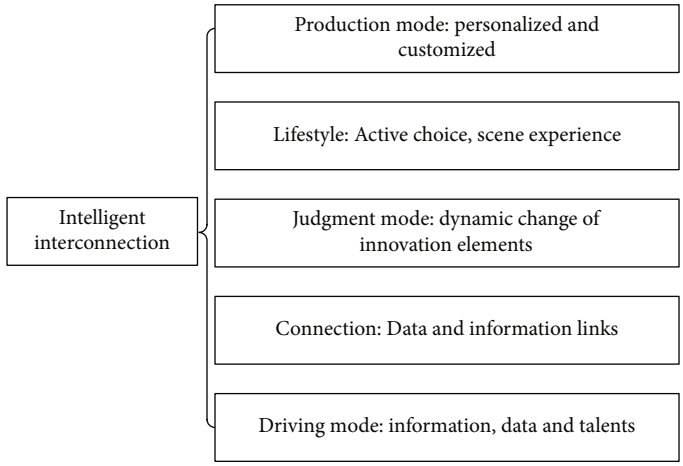

Figure 1: Characteristics of the era of intelligent interconnection.

plans are likely to be documented as more people take part in lockdown, with every project documented. The supply bottleneck in the supply chain can process and synchronize data. In the era of intelligent interconnection, technological innovation is emerging, and the Internet and cloud computing will have a far-reaching impact in the future. The technological revolution has entered all aspects, and many production organizations of human society will undergo changes.

2.3. Concepts Related to Intelligent Interconnection. Nowadays, the intelligent trend of everything is very fast. Intelligent interconnection of floor products in automobile, home, education, health, finance, and other industries, especially in the fields of Internet transportation, personal health, and smart home, has achieved remarkable results. With the advent of Internet intelligence era, it not only affects "intelligent" applications but also affects "intelligent" Internet and Internet terminals. The intelligence of Internet can be understood as wireless+artificial intelligence. Compared with traditional wisdom, intelligent network emphasizes "connection". It is not a simple connection, but it is related to users' attitudes and environmental factors, not one-sided, but continuous; the interruption of genius contains the connotation of "society" and positive thinking on environment and space. For example, the handwheel has a detection unit that evaluates the test result in combination with the physical characteristics of the user. We must ensure that our citizens can live in Europe. With the advent of Internet intelligence era, it not only affects "intelligent" applications but also affects "intelligent" Internet or Internet terminals. In the interconnected environment, empirical design is carried out for different software and hardware environments, and different time points and different structural characteristics are studied. At present, the design should pay more attention to user behavior, needs, and experience and make the design more suitable for specific environment and user needs on the basis of subsequent design. In an era of intelligent interconnection design that transcends form and media, it presents an orderly development, paying attention to the personalized needs, and humanization of users. But because there is no system, interrelated environments are independent. They exist in time, space, humanity, and creativity. Under such conditions, a large ecosystem of sharing information and information has been formed. The related technologies of intelligent interconnection are shown in Figure 2. Intelligent technology in its application is mainly reflected in the computer technology, precision sensing technology, and GPS positioning technology integrated application. With the increasingly fierce competition in the product market, the technical advantages of intelligent interconnection have been well used in practical operation and application, which are mainly manifested in greatly improving the working environment of operators and reducing the work intensity, improve the operation quality and work efficiency, some dangerous occasions or key construction applications have been solved, environmental protection and energy saving, the automation degree and intelligent level of the machine are improved, the reliability of equipment is improved, and the maintenance cost is reduced. Intelligent fault diagnosis is realized.

2.4. Concepts Related to Optimization of Intelligent Interconnected Systems. Intelligent interconnection system optimization is a means of system analysis terminology and computer terminology. It reduces the use of computers, changes the working mode, eliminates unnecessary interference, makes equipment more efficient, optimizes files, makes data read and write faster, reduces unnecessary hardware systems, and reduces the use of equipment. Intelligent optimization of the Internet can certainly affect the stability of the system to a certain extent, but it is harmless to the hardware. Optimization refers to finding one or more metrics in many scenarios or parameters in some cases to achieve the best or minimum performance. The optimization of interconnection system is widely used in signal processing, image processing, production scheduling, task allocation, pattern recognition, automatic control, and mechanical design. Optimization method is a mathematical solution, and various optimization methods have been widely used, resulting in huge economic and social benefits. Practice has proved that by improving the process, reducing energy consumption, rationally utilizing resources, increasing the number of equipment, and improving the system efficiency. This effect is most prominent in many complex economic disciplines such as electronics, communication, computer, and automation. In

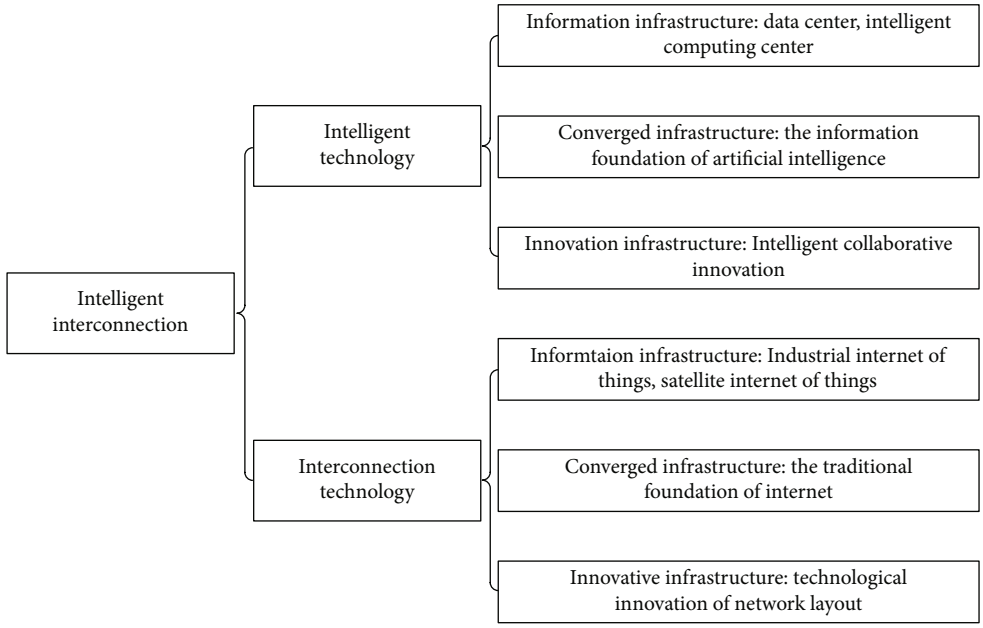

Figure 2: Classification of related technologies of intelligent interconnection.

the face of large-scale optimization problems, traditional optimization methods (newton, simplex method) must go beyond the search point and cannot complete the search in a short time, which easily leads to the failure of "joint search". For example, many system optimization problems often require complex and large-scale search to find the optimal or quasi-optimal solution. For complex interrelated nonlinear system problems, constraints, and modeling difficulties, seeking effective optimization algorithm has become an important research topic. In human life, biota effect is influenced by human or natural phenomena, that is, by simulating or revealing the reality and development of life phenomena and processes or intelligent groups. The specific related algorithms of system optimization are shown in Figure 3.

3. Related Algorithms of Blockchain

3.1. Consensus Algorithm of Blockchain. The advantages of blockchain are reflected in central transactions. In the packet chain system, all users are legal and equal participants, no participant can do accounting alone, and everyone can participate in transaction accounting, information disclosure, transaction audit, and so on. The most important guarantee is the consultation and consensus mechanism of blockchain. The issues dealt with by the consensus mechanism include the verification of transaction information and the holding of transaction objectives. First, block chain technology assumes that transactions are executed on nodes that are not completely reliable. Distributed data warehouse is also faced with network delay, slow transmission speed, data errors, security issues, and other issues. Therefore, the basis of consensus is to solve the fault tolerance problem in unreliable distributed environment. The basic strategy of block chain technology is to implement "reward system". Similarities on other block chain platforms are different only in reward currency or different amount of transaction costs. By analyzing the negotiation mechanism between packet chain and Ethernet space, the distributed computing formula of packet chain can be summarized as follows: the distributed correlation calculation of blockchain in Formula (1) can ensure that the system can reach an effective consensus correctly when there are no more than 1/3 untrusted nodes. The consensus on blockchain has the validity problem, and blockchain storage is decentralized, so in principle, it is each node's own right to participate in negotiation. Therefore, in calculating the consensus node of blockchain, it is necessary to use the correlation coefficient of blockchain to find the distribution of blockchain.

$$P(X_1 = F_1) = h(N, F, N_1, F_1) = \frac{C_{N-F}^{N_1-F_1} C_F^{F_1}}{C_N^{N_1}}. \quad (1)$$

Of course, with the wide application of blockchain technology, consensus algorithms have been fully studied, and many other consensus algorithms have appeared. According to the total probability formula and Formula (1), the distribution of the number of malicious nodes contained in the second fragment can be obtained, and the node formula can be expressed as

$$P(X_2 = F_2) = \sum_{F_1=0}^{F_1=\min(N_1,F)} [P(X_1 = F_1) \times P(X_2 = F_2 | X_1 = F_1)], \quad (2)$$

$$P(X_h) = [h(N, F, N_1 F_1) \times h(N - N_1, F - F_1, N_2, F_2)]. \quad (3)$$

The k-th blockchain means that the number of blockchain nodes contained in this slice does not exceed one-third. The

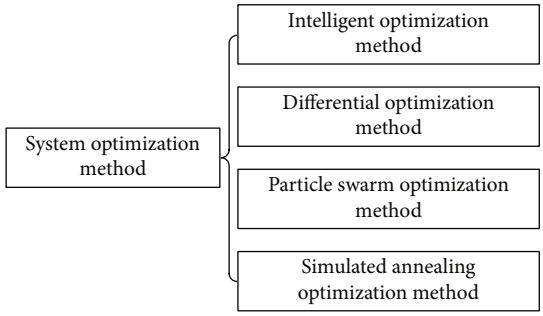

Figure 3: Related methods of system optimization.

blockchain model in this paper is a single-slice takeover model, so the security of blockchain fragmentation system means that all slices in blockchain system are secure. Therefore, this paper defines the security of blockchain system as the probability that all fragments meet the number of malicious nodes less than one-third. The mathematical expression is as follows:

$$S_{\text{system}} = P\left(X_1 \le \frac{N_1 - 1}{3}, X_2 \le \frac{N_2 - 1}{3}, \cdots, X_k \le \frac{N_K}{3}\right), \quad (4)$$

$$S_p = \sum_{F_1=0}^{((N_1-1)/3)} \cdots \sum_{F_k=0}^{((N_k-1)/3)} P(X_1 = F_1, \cdots, X_K = F_K). \quad (5)$$

Formulas (4) and (5) calculate the number of nodes contained in blockchain fragments, in which a mathematical model is established for calculating the number of nodes, and the number of distributed computing nodes is proposed. Therefore, according to the functional relationship of the mathematical model, it can be concluded that the number of nodes in the blockchain in Formulas (4) and (5) is determined by the fragmentation position of the blockchain and the number of malicious nodes in the blockchain. Among them, the farther the blockchain is fragmented, the more skilled the nodes of the blockchain will be.

The correlation coefficient of blockchain consensus distribution is defined as the mathematical expectation of the proportion of security fragments in the system, and its mathematical expression is as follows:

$$S_{\text{task}} = \sum_{h=0}^{K} \left[\frac{h}{K} P(H = h)\right]. \quad (6)$$

When the blockchain system generates a new block every other block interval, the average number of tasks contained in a new block in the i-th block is that the blocks arriving at the consensus subsystem obey the single-point distribution of arrival rate. Assuming that the average data volume of a task is 6 and the block header size is the average size of the new block in the Z-th partition. Assuming that the Z-th slice contains the edge nodes, according to the calculation formula of block delay, the calculation formula of the average time for the consensus subsystem in the I-th slice to reach consensus on a block is as follows:

$$T^i_{\text{consensus}} = \frac{1}{\mu} = T^i_{\text{prop}} + T^i_{\text{val}} + T^i_{\text{exe}}. \quad (7)$$

Assuming that the time of consensus blocks in the consensus subsystem obeys this exponential distribution, then the number of blocks A that the consensus subsystem completes consensus within a block generation interval W obeys Poisson distribution, and the probability of reaching consensus within a block chain interval is as follows:

$$S_k = P(A = k) = \frac{\left(\mu_2 T'\right)^k}{k!} e^{-\mu_2 T'}. \quad (8)$$

Taking blockchain consensus as a state, a discrete-time Markov chain is established. The probability of state transition when a new block is generated is related to the number of blocks in the consensus subsystem when each block is generated and the number of blocks completed by the consensus subsystem within the block interval. The relationship is as follows:

$$S_n = S_{n-1} + 1 - A(0 \le A \le S_{n-1}, n \ge 1). \quad (9)$$

3.2. Blockchain Delay Throughput. In the new block array of standard style, the block chain constructor creates T7 space in each block, resulting in a maximum of 5 max blocks. If not more than one-third of the malicious nodes are collected, the garbage in the event nodes can be agreed on the new block. Therefore, every transaction processed by secure fragmentation is effective and contributes to the total throughput of the system. However, in unsafe fragmentation, the number of malicious nodes exceeds one-third, and honest nodes cannot reach a consensus on new blocks. The fragmented blocks generated by this fragmentation are invalid, and the transactions contained are also invalid, so unsafe fragmentation has no contribution to the throughput of the system. Different fragments work in parallel, so the throughput of the system is the sum of the throughput of all secure fragments. Assuming that the block size generated by the node is S, the average size of each transaction is Z, and the block header size is 80 bytes, and then the transaction processing rate of a secure fragment is S/Z. From this expression, it can be seen that increasing the block size S and reducing the wide interval between blocks can improve the throughput of a secure fragment. The values are shown in the formula.

$$D = \frac{1}{mn} \sum_{i=1}^{m} \sum_{j=1}^{n} (g(i,j) - \bar{g})^2. \quad (10)$$

The throughput of blockchain system is defined as the sum of the throughput of all fragments. The throughput of the system can be improved by increasing the throughput of a safe fragment or increasing the number of safe fragments. The mathematical expression is as follows: the throughput of blockchain refers to the throughput calculation formula of the number of tasks that can be processed per second in the blockchain system and obtains the blockchain throughput mentioned in Formula (11). The total throughput is subdivided into

fragmented throughput. Formula (11) represents the functional relationship between the safe slice throughput and the total throughput of the blockchain, where the number of safe slice throughput is proportional to the size of the safe block.

$$\eta = \sum_{i=1}^{K} \eta_i = \sum_{i=1}^{K} \left(\delta_i \frac{|(B_i - B_H)/b|}{T^I i} \right). \tag{11}$$

Blockchain delay is one of the important performance indicators for evaluating the system, including block delay and service delay. Block delay refers to the time taken from the time when the service is sent to the blockchain network to the time when the final service is processed; service delay refers to the time from the time when the service is generated by the terminal to the time when the service is sliced and returned to the terminal. Compared with the existing edge computing systems, the proposed scheme adds a consensus process when processing services. In the consensus process, nodes need to exchange and verify messages and verify block transactions. This means that the more consensus nodes in a single fragment, the more information exchanged in the consensus process, which leads to the longer time to verify these information. Therefore, the slice size is one of the factors affecting the delay. In this section, we use queuing theory, Markov chain, and other mathematical knowledge to model the block delay and service delay of the fragmentation scheme proposed in this paper. Block delay refers to the time between the creation of a block by a packaging task and the completion of the final block consensus. Tasks submitted to the blockchain network will be assigned to different fragments, which will be processed and agreed by nodes in the fragments. *The Modeling Process of Block delay in the Literature*. Block delay consists of two parts: block generation interval and consensus time. The expression of blockchain delay is

$$T^i_{\text{Blatency}} = T^I + T^i_{\text{con}}. \tag{12}$$

Blockchain consensus delay includes message propagation, message verification, and task execution delay in the consensus process. Therefore, the mathematical expression of consensus delay is

$$T^i_{\text{con}} = T^i_{\text{prop}} + T^i_{\text{val}} + T^i_{\text{exe}}. \tag{13}$$

It consists of block chain message generation verification delay, request execution delay, and block propagation delay. The following is the modeling process of these three parts of delay. The mathematical expression of blockchain delay for peer node verification and message generation in the i-th slice is as follows:

$$T^i_{\text{val}} = \frac{M_i\theta + 4(N_i - 1)\alpha}{c}. \tag{14}$$

Because the master node executes the task first, and then the replica node receives the block and then executes the tasks contained in it and compares the results, the time for executing the task needs to be multiplied by 2, that is, the time for executing the task in the consensus process is shown in the formula.

$$T^i_{\text{exe}} = \frac{2M_i\beta}{c}. \tag{15}$$

Replica nodes that do not respond within the specified time of the blockchain are considered to oppose the corresponding consensus steps, that is, the new blocks of the blockchain are considered invalid. The mathematical expression of the propagation delay of the new block is as follows:

$$T^i_{\text{prop}} = T^i_{\text{prepre}} + T^i_{\text{pre}} + T^i_{\text{comm}}, \tag{16}$$

$$T^i_{\text{prepre}} = \min \left\{ \max_{j \neq l} \frac{B_i}{R_{n_{i,j} n_{il}}}, \varepsilon \right\}. \tag{17}$$

Therefore, the mathematical expression of the total delay of the new block of the i-th block chain fragment is as follows:

$$T^i_{\text{Blatency}} = T' + T^i_{\text{con}} = \frac{M_i\theta + 4(N_i - 1)\alpha}{c} + \frac{2M_i\beta}{c}. \tag{18}$$

The service delay of blockchain refers to the time from the time when the terminal generates the service to the time when the service is fragmented and then returned to the terminal. The service delay can be divided into the transmission time of request and response and the processing time of request in blockchain fragmented network. Assuming that the system contains a total of K slices, the mathematical expression of the service delay of blockchain is

$$D^i_{\text{task}} = D^i_{\text{transmitting}} + D^i_{\text{processinng}}, \tag{19}$$

where the mathematical expression for the transmission time of the request response is

$$D^i_{\text{transmitting}} = \frac{b}{R_{m_{i,j}, n_{i,p}}} + \frac{q}{R_{n_{i,j}, m_{i,p}}}. \tag{20}$$

The total service delay of blockchain in Formula (19) is the time parameter from the initial service delay to the terminal service delay and the time experienced by the blockchain after adding the security slicing processing. In Formula (20), the transmission time of request response is a functional relationship, and the transmission time is transformed into a mathematical inverse function model, in which the response request time of blockchain is inversely proportional to the best effort time of processing the secure fragmented complex terminal process. At the same time, it is proportional to the number of safe fragments. It shows that the more secure fragments, the longer the response transmission time of blockchain.

After receiving the request, the master node of blockchain will verify the signature of the request (average computation amount is 0) and the result of executing the task (average computation amount). Assume that the processing time of tasks in the i-th subblockchain system obeys the exponential distribution, and the processing time of tasks in the blockchain master node is as shown in the formula.

$$T^{i}_{\text{packing}} = \frac{1}{\mu_1} = \frac{\beta + \theta}{C}. \tag{21}$$

According to the average stay time of users in the system in the queuing theory model of blockchain, the average delay of tasks in the blockchain packaging subsystem is shown in the formula.

$$D^{i}_{\text{packing}} = \frac{1}{\mu_1 - \lambda^{i}_{\text{packing}}}. \tag{22}$$

4. Optimization of Intelligent Interconnection System Based on Blockchain

4.1. Research on Intelligent Interconnection System of Blockchain. The characteristics of blockchain technology and its advantages in solving intelligent interconnected systems are reflected in the following four aspects: blockchain is based on decentralized architecture, without central units, and can be used to provide scalable security solutions. Through the joint maintenance of distributed nodes in blockchain, the hidden dangers of intelligent interconnection and centralized storage are solved. *Reliability:* because the blockchain is distributed, there is no single point of failure. This improves the reliability of the system. In intelligent interconnection, a large number of nodes ensure the correctness of data sharing through a unified protocol, so the appearance of malicious nodes will not affect the whole data sharing system. *Cryptocurrency Support:* many technology platforms in the blog chain provide open and transparent cryptocurrency trading services. All nodes involved in the blockchain network can access the contents of the shared chain database to ensure that the open and transparent data sharing environment between nodes is uninterrupted. Adopting the unified mechanism and encryption technology of distributed nodes can solve the problem of data interruption in spelling connection. Through intelligence, the data in malicious nodes is difficult to be tampered with, thus ensuring the integrity of the data. *Anonymity:* using blockchain, each user is bound to a false address, thus ensuring the privacy of users in intelligent interconnection systems. *Transaction Automation:* through intelligent contract processing, data exchange resource sharing services are automatically realized without manual intervention, thus realizing the transformation of contract problems in intelligent interconnection, thereby realizing the automatic execution of intelligent interconnected transactions. It can be seen that the characteristics of blockchain technology can provide a transparent, safe, scalable, and privacy-protected environment for intelligent interconnected systems without central supervision by third parties. The following table shows the advantages of blockchain technology over traditional security technologies in solving the problem of optimizing intelligent interconnection, as shown in Table 1.

When studying intelligent interconnected systems based on blockchain, there are three different types of blockchain, which play different roles in the research of intelligent interconnected systems. According to the operation mechanism, blocking chain can be divided into three categories: public chain, private chain, and alliance chain. Common chain is an unconstrained and unauthorized distributed reservation system. Anyone who uses the intelligent interconnection system can register as an authorized node on the blocked link platform and become a part of the blocked link network and access current and historical data, check the operation or work certificate in the input block, and participate in mining. The data in the public chain cannot be changed, that is, when the data block is created and added to the public chain, it cannot be modified or deleted, so that everyone can access the data, but the data cannot be modified. These blocked foods are often used to cryptocurrencies such as bitcoin, weights and measures, and ethereal. Private chain is a restricted type or blocked chain, which requires a license. It only works in a closed network, and only preselected devices can use packet chain. These devices are selected with their own permissions and granted to the block developer when building the block application. Private group chains are primarily used to store sensitive data for private organizations that are used only by people in a particular organization. This is a central storage system when you look at the private chain from the outside of the system, but when you look at each node of the system, the power of each node in the system is the same. Trade unions are a combination of public and private chains. These blocked foods are made up of a group of people who share information. In a connection block, some nodes run as private blocks, and only authorized users are allowed to access them. Some nodes operate as common blocks, allowing all users unrestricted access to data, eventually forming a combined block-connected network. Among them, the classification of blockchain research on intelligent interconnection systems is shown in Table 2. By comparing the characteristics of the three blockchain technology types, we can see from the table that the public chain has the highest degree of decentralization and openness, and the largest network scale, but its confidentiality is lower, which is suitable for application scenarios with high requirements for trust, security, and durability, such as finance, asset registration, and voting. Private chain centralization has the best confidentiality, faster transaction speed, and less cost demand, but its scale is small and the degree of decentralization is low, which is suitable for internal applications of a single enterprise, such as database management and audit. Alliance chain is between public chain and private chain, and its permission design requirements are often more complex, which is suitable for joint applications among enterprises.

For the optimization of intelligent interconnection system, the architecture of blockchain is generally divided into six architecture levels. It consists of data layer, network layer, consensus layer, incentive layer, contract layer, and application layer and has network layer, propagation mechanism, verification mechanism, and consensus layer of different consensus algorithms of PoW network. The six-tier architecture of blockchain is shown in Table 3.

4.2. Optimization Decision of Intelligent Interconnected System. In the optimization scheme of intelligent interconnection system in blockchain, the total cost of intelligent system in composite mode is better than that in independent mode. At the same time, the complementarity of block chain is further utilized, which makes the intelligent interconnection system

Table 1: Performance comparison between blockchain and traditional technology.

Intelligent interconnected system data	Traditional technical solutions	Blockchain technology solutions
Node cooperation problem	Supervision by trusted third-party institutions	Incentive mechanism based on credit and cryptocurrency
Node trust problem	The central node endorses credit for all nodes	Nodes prove their trust
Centralized storage problem	Data storage system relying on central node	Decentralized and maintained with distributed nodes
Data flow problem	Centralized organization establishes firewall	Encryption algorithm is used to ensure the integrity of data flow
Privacy leakage problem	Nonpublic anonymous authentication of centralized institutions	Anonymous asymmetric encryption to protect privacy data

Table 2: Classification and comparison of regional chains.

Contrast item	Public chain	Private chain	Alliance chain
Node size	Whole network node	Private node	Partial node
Data reading	Arbitrary read	Restricted read	Restricted read
Confidentiality	Low	Gao	Higher
Degree of openness	Completely open	Full encryption	Partially open and partially encrypted
Degree of centralization	Decentralization	Centralization	Semi-centralization
Consensus mechanism	PoW	RAFT	PBFT

reliable while obtaining the best economic benefits. In addition, in order to ensure the reliability of system optimization, by comparing the total cost of intelligent interconnection optimization under the same mode and the same type, it can be seen that under the blockchain interconnection mode, the capacity is effectively reduced by supplementing the use of natural resources. The comparison between intelligent interconnected system and intelligent independent system is shown in Figure 4. As can be seen from the comparison of intelligent interconnection optimization decisions in Figure 4, Comparing the optimization degree of node size and data security in intelligent interconnection system, it can be seen that the optimization degree of intelligent interconnected system is better than that of intelligent independent system, but the optimization ability of intelligent interconnected system is only a little better than that of intelligent independent system in terms of data reading, user privacy, and neutral storage. Therefore, optimization comparison shows that in terms of system optimization, the optimization ability of intelligent interconnection is higher than that of independent optimization. Compared with independent intelligent interconnected systems, intelligent interconnected systems improve the overall economic performance of the system.

Compared with when users experience the intelligent interconnected system, before the intelligent system is optimized, we randomly select 100 users of the intelligent interconnected system and investigate and analyze their use of the intelligent interconnected system, so as to analyze the relevant options for the optimization decision of the intelligent interconnected system. Among the 100 randomly selected users, there are trust in the system, update iteration, security, privacy, personalization, interaction form, reward mechanism, and interface layout. Among them, users need to make relative statistics, so as to determine the scheme and direction of intelligent interconnected systems that need optimize decision-making. The survey data is shown in Figure 5. In the part of intelligent system optimization, the optimization degree in the middle stage of system optimization is higher than that in the end stage of intelligent system optimization in system trust, system security, and system reward mechanism, and the optimization degree in the end stage of optimization is higher than that in the middle stage of optimization in update iteration, system privacy, system personalization, system interaction form, and system interface layout. It mainly shows that in the process of optimization of intelligent interconnected systems, most of the places are getting better and better, and only a few of them are missing after optimization. It shows that in the process of optimizing intelligent interconnection system, attention should be paid to combining the missing parts.

According to the related contents of intelligent interconnected system optimization, randomness and fuzziness are two main forms of uncertainty of intelligent interconnected system. Therefore, the optimization decision of intelligent interconnected systems is often a multiobjective, multilevel, and multistage system optimization decision-making process. The relationship among decision objectives, constraints, and object attributes is also very complex. The basic principles of optimal decision-making for intelligent interconnected systems are optimization principle, system principle, full information principle, feasibility principle, and group decision-making principle. Optimization principle is an important decision-making principle. However, in practical applications, many problems have no optimal

Table 3: the meaning and role of each level of blockchain.

Correlation hierarchy	Definition	The role of intelligent interconnected systems
Data layer	The data layer includes the structure of connecting additional data blocks and related technologies	Realize the storage security of intelligent interconnection
Network layer	The network layer has allocation mechanism and verification mechanism	Build a model to obtain the messages needed by intelligent interconnected systems
Consensus layer	It is the core technology governance mechanism of blockchain	Intelligent interconnected systems can be maintained through computational updates
Excitation layer	Mining mechanism (how much contribution is made and how much reward is received)	Encourage nodes to participate in the security maintenance of intelligent interconnected systems
Contract layer	The control of blockchain process can be carried out through the contract layer and controlled through the language specified in the contract	Make the intelligent interconnected system have the characteristics of autonomy and decentralization
Application layer	Analyze the application of use case deployment blockchain	Creating resources, the development of intelligent interconnection system has entered a new stage

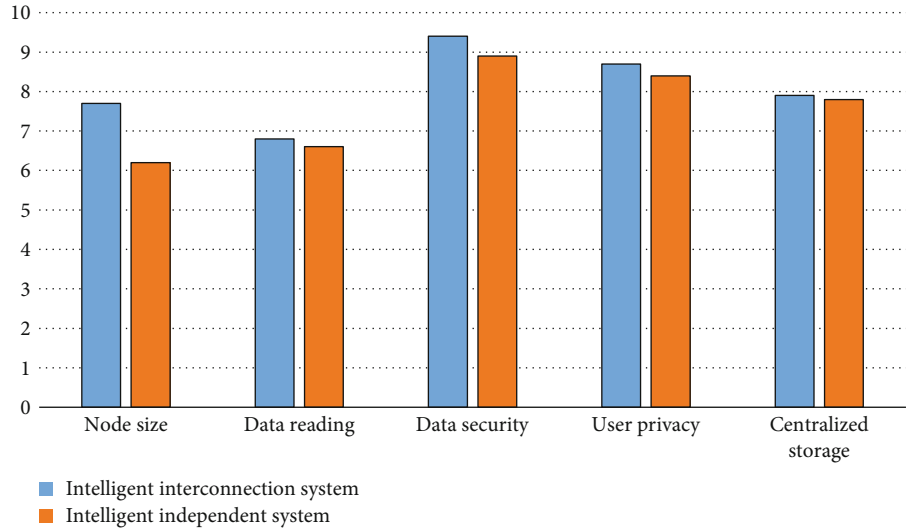

Figure 4: Comparison of optimization decisions of intelligent interconnected systems.

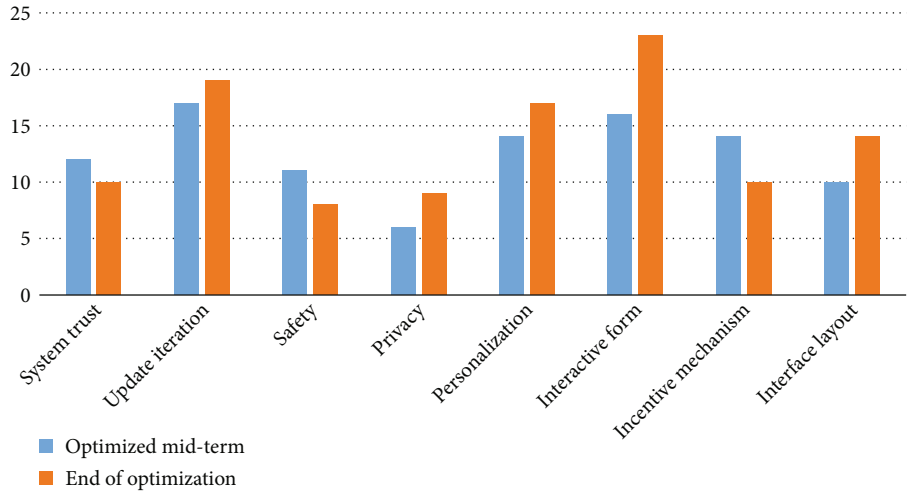

Figure 5: Frequency statistics of optimization decision influence of intelligent interconnected system.

Table 4: Optimization methods corresponding to intelligent interconnection optimization decisions.

Optimal decision-making method of intelligent system	Corresponding methods for optimization of intelligent interconnected systems
System efficiency method	Cognitive evaluation of the system in a larger system in an intelligent interconnected system
Analytic hierarchy process	Through the comprehensive judgment and analysis of the components of the intelligent interconnected system, the intelligent interconnected system is applied to practice
Data envelopment analysis	The evaluation of intelligent interconnected systems is multi-input and multioutput decision, and the relative efficiency of interconnected intelligent systems is improved
Intelligent computational decision method	Using information technology artificial intelligence to improve the optimization of intelligent interconnected systems
Group decision theory	Combining communication technology and decision theory, the uncertainty of intelligent interconnected system optimization is solved.

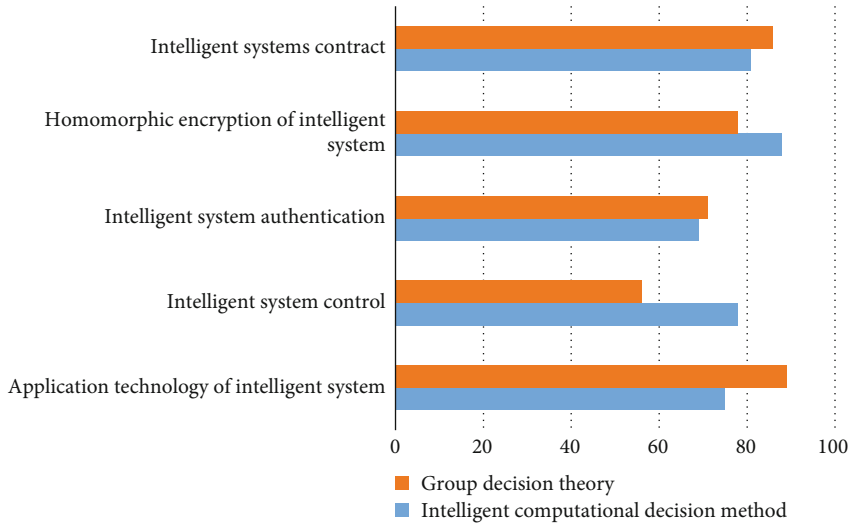

Figure 6: Comparison of optimization decisions of intelligent interconnected systems.

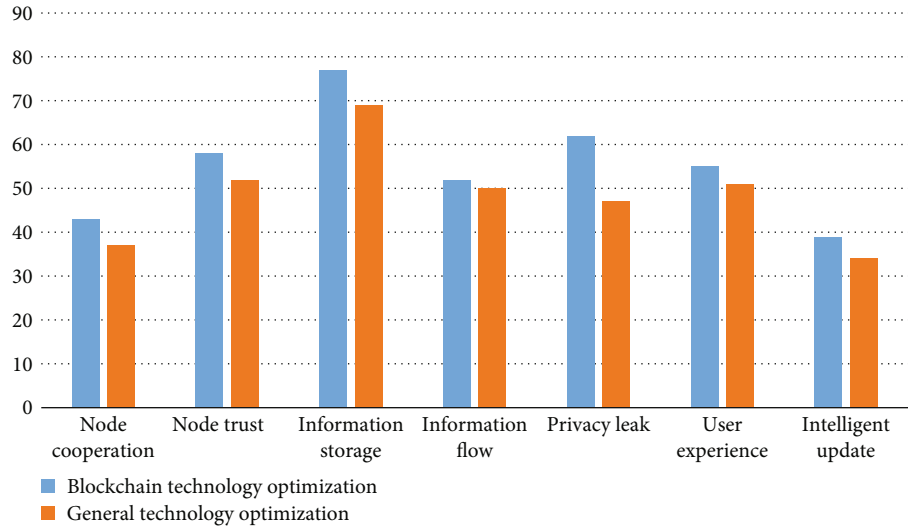

Figure 7: Comparison of optimization decisions of intelligent interconnected systems by different technologies.

Table 5: Comparison of consensus optimization of blockchain.

Blockchain consensus	Degree of decentralization	Application scenario	Security threat	Maximum number of fault-tolerant nodes	Byzantine fault tolerance	Resource consumption	Speed
PoW	Completely	Public chain	Concentration of computing power	50%	Support	Gao	Slow
PoS	Completely	Public chain	Candidate collaboration	50%	Support	Medium	Quickly
PBFT	Semi-centralization	Private chain	Master node failure	33%	Support	Low	Slow
Raft	Semi-centralization	Alliance chain	Leader node failure	50%	Support	Low	Quickly

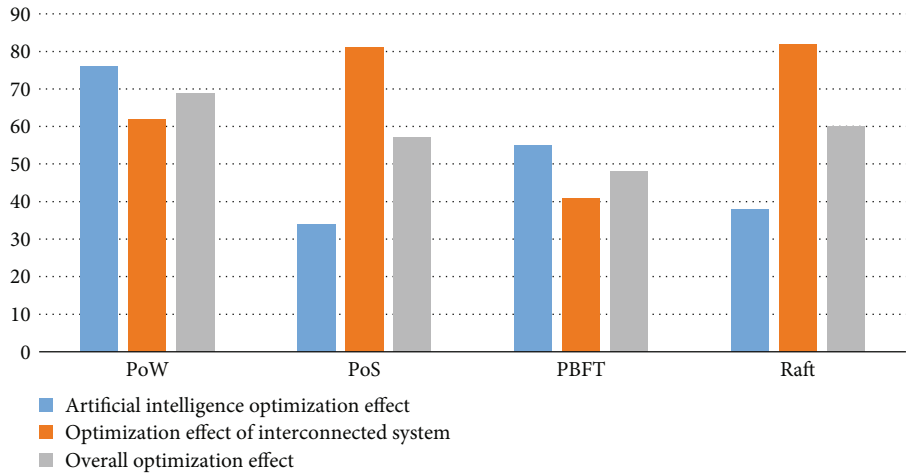

Figure 8: Comparison of optimization effects of blockchain consensus on intelligent interconnection system.

solution or cannot find the optimal solution. Therefore, according to the basic principle of "optimizing satisfaction degree", it is very necessary to find satisfactory solutions, feasible solutions, and even low-quality solutions. Among them, the optimization decision-making methods and applications of intelligent interconnected systems are shown in Table 4. At present, intelligent computing methods have been widely used in many fields such as logical reasoning, classification decision-making, and global optimization. Based on the principle of clarifying concepts and principles, touching the frontier development and paying attention to applying what you have learned, this paper systematically introduces the concepts, principles, models, and typical application examples of commonly used intelligent computing methods in four units: fuzzy computing, neural computing, evolutionary computing, and swarm intelligent computing. This book can be used as a teaching material for graduate students and senior undergraduates majoring in control science and engineering, computer science, and information science, as well as a reference for university teachers, researchers, and engineers engaged in intelligent computing and intelligent decision-making.

With the development and perfection of capital and steps, the development of intelligent interconnection technology in China is deeply analyzed. Research shows that large-scale intelligent interconnection technology will become a new economic model, as a business model, and build a reliable new social system. Because of the concept of intelligent interconnection technology, the efficiency of intelligent interconnection sensor scheme and smart camera is declining, and the optimization of artificial intelligence and intelligent interconnection scheme can be used in intelligent interconnection technology in this paper. Therefore, the system optimization decision-making method of intelligent interconnection is analyzed in detail, and the technical decision-making of intelligent interconnection optimization is decided. The analysis results are shown in Figure 6.

4.3. Intelligent System Optimization Decision of Blockchain. Blockchain has the characteristics of decentralized and distributed storage, which can solve the problems of centralized feedback and inaccurate feedback in traditional intelligent connection systems. At present, scientists have done a lot of research on how to apply blocking links to intelligent interconnection. Various application prospects of block circuit in intelligent connection system are summarized. This paper discusses the advantages and technical challenges of block link in intelligent interconnection and proposes an intelligent framework based on block. In the literature, an intelligent interconnection anonymous data merging system based on block line is studied. The system divides users into a group, and each group has a special block chain for storing member information, uses filters for fast identity authentication, and stores nodes in the block chain, which improves the security of the system and has better performance than other schemes. In

the literature, a secure anonymous data merging scheme based on two-block graph is proposed, which provides powerful support for efficient and secure data mining of intelligent interconnection. Although block link has many advantages in intelligent interconnection, it still has its own limitations. The contents of optimization of intelligent interconnection system by regional network and optimization decision of intelligent interconnection by common technology are shown in Figure 7.

In order to improve the intelligent interconnection block diagram, there are four consensuses. Different application scenarios need to choose different consensus algorithms. The application scenario of this paper is the optimization of intelligent interconnection system. In the intelligent interconnection system, in order to ensure the stable and safe operation of the system, it is necessary to analyze massive data to make the data information time-sensitive. Therefore, if blocking technology is applied to the security of intelligent interconnection systems, a simpler and faster packet protocol algorithm is needed. The consensus comparison of blockchain is shown in Table 5.

In order to study the performance optimization comparison of blockchain consensus on intelligent interconnected systems, we put the four blockchain consensus PoW of blockchain, PoS, PBFT, and Raft optimize the intelligent interconnection system, respectively, so as to obtain the optimization effect of relevant blockchain consensus on the intelligent interconnection system. We set the total optimization degree as 100, which is divided into five grades. The optimization effect of 80-100 is excellent, the optimization effect of 60-80 is good, the optimization effect of 40-60 is average, the optimization effect of 20-40 is poor, and the optimization effect of 0-20 is very poor. In the optimization of intelligent interconnected systems, it is generally divided into artificial intelligence and relative optimization of interconnected systems. After experiments, the experimental results are shown in Figure 8. Figure 8 is a comparison of artificial intelligence optimization and interconnected system optimization results for PoW, PoS, PBFT, and Raft in blockchain consensus. Comparison shows that the optimization effect of artificial intelligence on PoW is higher than that of interconnected systems, but the optimization effect on PoS and Raft is significantly higher than that of artificial intelligence. Therefore, the comparison shows that the optimization effect of interconnected systems is relatively good. Overall, combined with artificial intelligence and interconnected systems, PoW and Raft are easier to optimize than PoS and PBFT.

5. Concluding Remarks

Blockchain is a decentralized network, in which intelligent interconnection systems can easily obtain information. Intelligent interconnection is the key system in the future, which not only provides stable and feasible services but also efficient and reliable services, but it also relies on frequent data collection and interconnected data links, which brings spatial challenges. The optimization of intelligent interconnected systems becomes important. In this paper, it is proposed that blockchain has the characteristics of optimizing the data of intelligent interconnected system, and the decentralized structure naturally solves the optimization problem of intelligent interconnected system. In order to optimize the intelligent interconnection system, this paper combines the new blockchain technology with intelligent interconnection data and replaces the traditional centralized storage structure with decentralized data storage structure. Intelligent interconnection system brings many conveniences, but it also brings more and wider data threats. At the same time, we make good use of the advantages of extensive blockchain data to improve the data of intelligent interconnection system. Therefore, under the premise that blockchain develops so rapidly, we should make rational use of the characteristics of blockchain to help optimize the system.

Data Availability

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

Conflicts of Interest

The author declared that there are no conflicts of interest regarding this work.

References

[1] M. Iansiti and K. R. Lakhani, "The truth about blockchain," *Harvard Business Review*, vol. 95, no. 1, pp. 119–127, 2017.

[2] P. Hemalatha, "Monitoring and securing the healthcare data harnessing IOT and blockchain technology," *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, vol. 12, no. 2, pp. 2554–2561, 2021.

[3] N. Kshetri, "1 Blockchain's roles in meeting key supply chain management objectives," *International Journal of Information Management*, vol. 39, no. 1, pp. 80–89, 2018.

[4] H. R. Bokkisam, S. Singh, R. M. Acharya, and M. P. Selvan, "Blockchain-based peer-to-peer Transactive energy system for community microgrid with demand response management," *CSEE Journal of Power and Energy Systems*, vol. 8, no. 1, pp. 198–211, 2022.

[5] J. Su, L. Zhang, and Y. Mu, "BA-RMKABSE: blockchain-aided ranked multi-keyword attribute-based searchable encryption with hiding policy for smart health system," *Future Generation Computer Systems*, vol. 132, no. 4, pp. 299–309, 2022.

[6] O. Novo, "Blockchain meets IoT: an architecture for scalable access management in IoT," *IEEE Internet of Things Journal*, vol. 5, no. 2, pp. 1184–1195, 2018.

[7] H. Zhao, W. Liu, and L. I. Yongjie, "Transformation and upgrade of the traditional industry based on big data intelligent interconnection platform for iron-making," *Big Data Research*, vol. 70, no. 3, pp. 628–644, 2017.

[8] F. Wang, X. Huang, F. Yang, H. Yang, J. Wang, and J. Song, "Internet of lamps for future ubiquitous communications: integrated sensing, hybrid interconnection, and intelligent illumination," *China Commun*, vol. 19, no. 3, pp. 132–144, 2022.

[9] J. Huang, "Recognizing and planning contemporary technological and industrial transformation with intelligent interconnection thinking," *Research on Economics and Management*, vol. 29, no. 2, pp. 54–66, 2017.

[10] R. Shen and G. Dong, *Proceedings of the 28th Conference of Spacecraft TT&C Technology in China: Openness, Integration and Intelligent interconnection*, vol. 445 of Lecture Notes in

Electrical Engineering, Tsinghua University Press, Beijing, China, 2018.

[11] J. Decarolis, H. Daly, and P. Dodds, "Formalizing best practice for energy system optimization modelling," *Applied Energy*, vol. 194, no. 1, pp. 184–198, 2017.

[12] L. Sun, L. Gai, and R. Smith, "Site utility system optimization with operation adjustment under uncertainty," *Applied Energy*, vol. 186, no. 3, pp. 450–456, 2017.

[13] J. Luo, Y. Shen, Y. Qi, Y. Zhang, and D. Xiao, "Evaluating water conservation effects due to cropping system optimization on the Beijing-Tianjin-Hebei plain, China," *China. Agricultural Systems*, vol. 159, no. 4, pp. 32–41, 2018.

[14] J. Liu, J. E. Kang, X. Zhou, and R. Pendyala, "Network-oriented household activity pattern problem for system optimization," *Transportation Research Procedia*, vol. 23, no. 3, pp. 827–847, 2017.

[15] C. Yan, J. Zhu, Y. Ouyang, and X. Zeng, "Marketing method and system optimization based on the financial Blockchain of the internet of things," *Wireless Communications and Mobile Computing*, vol. 2021, Article ID 9354569, pp. 1–11, 2021.