

Research on Education Information Management of Primary and Secondary Schools based on Blockchain

Zhidan Huang

Shenzhen Yadi School, Shenzhen, China

Abstract

As a new data security technology, blockchain has become an important tool for innovation and development, and has been applied in various fields of production and life. Aiming at the problems of centralized data management and non openness and transparency in the past, this paper studies and designs the primary and secondary school status information management system by using the advantages of blockchain, introduces the basic concepts and key technologies of blockchain, expounds the current situation of primary and secondary school education information management system, constructs a model, and analyzes the functional advantages, future development trend and changes. The system can realize the openness and transparency of enrollment, curb and track the fraud of student status, and improve the comprehensive management level of education information system.

Keywords

Blockchain; Education Distributed; Information Management.

1. Introduction

With the development of information technology, taking bitcoin as the underlying technology and using hash algorithm to realize the successive link of data blocks, a new technology integrating network communication, data encryption, security sharing, data storage and other disciplines - blockchain has emerged. Using modern information technology, the state promotes the application of e-government, pays more attention to the security and sharing of data, changes the traditional service guide, effectively improves the service efficiency and promotes the openness and fairness of resource sharing. The balanced distribution of educational resources has always been a hot and difficult point at present. Solving the distribution of educational resources through traditional methods leads to the change of many data and the loss of fairness. The imbalance of educational resources has existed for a long time: urban and rural areas, East and West, large, medium and small cities have bred the "industrial chain" of college entrance examination immigrants, the teachers have "Peacocks Flying Southeast", and the schools employ foreign teachers in violation of regulations. Data security, confidentiality and sharing through blockchain can realize fair sharing and open competition of resources to a great extent.

The development of cloud computing and big data provides convenient channels for student status sharing, education and qualification verification. Usually, the data is migrated to the "cloud" and quickly positioned through big data technology analysis. However, all data comes from the database established by the unit, which is analyzed and positioned centered on the "unit database". Data storage centralization is like the star topology of network connection. Once the central point data is destroyed, the cloud storage data will be leaked. The destroyer can also modify or fabricate the data on the cloud database server through the terminal, resulting in data distortion. Illegal personnel can change school status and other information, and the consequences are very serious.

The development and application of blockchain technology has brought new opportunities to solve this problem. Blockchain encrypts data according to the principle of operating system data storage and with the help of cryptography, that is, data encryption, distributed data storage, point-to-point transmission and consensus. Mechanism is a new application mode of computer technology. A peer-to-peer electronic cash system was first proposed by Nakamoto in 2008 to realize the concept of direct cash transaction without intermediary [1]. Blockchain technology has changed the shortcomings of traditional transactions, such as trust between merchants and customers, easy disclosure of personal information, invisible cost increase of intermediary transactions, etc. The realization of technology is to ignore banks and third-party intermediaries in the whole transaction, and allow strangers to trade e-money directly on the Internet. Blockchain is distributed, hard to tamper with and traceable. Starting from financial application, blockchain is gradually extended to industries and fields such as medical treatment, copyright and supply chain.

2. Application Status

In the era of big data, the integration of modern technology into teaching management has become the trend of the times. In 2016, the Ministry of industry and information technology issued the white paper on China's blockchain technology and application development, which established the status of blockchain in China's economic development, It also points out that "the characteristics of the blockchain system, such as transparency and non tampering of data, are fully applicable to student credit investigation management, enrollment and employment, academic, qualification certification, industry university cooperation and other aspects, and are of great value to the healthy development of education and employment." [2] At the beginning of 2018, the Ministry of Education issued the education informatization 2.0 action plan. In October of the same year, the country's first big data education blockchain pilot zone was launched in Langfang [3]. "Education informatization has entered the 2.0 era, and China's education informatization challenges and opportunities coexist. The current education informatization construction is still self-supporting, and the pain points such as data islands need to be solved urgently. Blockchain technology will bring more imagination to education." Taking bitcoin as the prototype, the blockchain has been successively applied to financial digital asset trading, health record file system, logistics supply chain traceability, digital copyright of works and other scenarios after research and development in recent years. For the application in the field of education, the research results are not rich. At present, it is mainly aimed at the application of college academic integrity archives, learning activity credit record management, online education and expansion track. There is no model construction for the primary and secondary education system, and there are relatively few literatures.

3. Construction of Educational Information Management System Model based on Blockchain Technology

Sharing is an insurmountable barrier to data interaction, resulting in repeated construction of department or unit information system, increased cost and lack of incentive. In recent years, the government has actively advocated data sharing, effectively solved the data bottleneck problem, realized data interconnection and improved the efficiency of government affairs. Blockchain is a decentralized distributed data accounting technology, which enables all nodes in the network to jointly own, supervise and manage data assets through cryptography technology. It has the characteristics of decentralization, openness, non tampering, non forgery, consistent storage, traceability and consensus mechanism. The hash algorithm is used for data storage, and the data recorded in multiple "account books" are encrypted. The access front end

adopts identity identification through multiple technologies achieve data sharing, confidentiality and security, and also save access records in the form of multiple account books.

3.1. Blockchain

Blockchain technology refers to a decentralized technology infrastructure composed of multiple nodes based on asymmetric encryption chain block structure, distributed node consensus protocol, P2P network communication technology and smart contract. Blockchain technology is an integration of many mature technologies.

3.2. Analysis and Design of Student Status Management in Primary and Secondary Schools

The introduction of blockchain technology into primary and secondary school education information system management is forward-looking, is of great significance to the construction of education information management, and is also the requirement of contemporary education information. The application value of blockchain technology in the field of primary and secondary education lies in breaking the regional imbalance of the distribution of educational resources and realizing the sharing of educational resources, so as to effectively improve the level of primary and secondary education and comprehensively improve the level of national education. Combined with the traditional model, this paper analyzes and compares the reconstruction of the educational information management model of primary and secondary school student status management and school teacher team management, in order to solve the imbalance of resources and the unfairness of competition.

Building the system with blockchain technology, changing the traditional management mode and improving the management level is also in line with the idea of "serving the last kilometer". The object data is encrypted and stored in the form of public chain and private chain respectively. The acquirer can view the data only with the key obtained after being authorized. Only special terminal objects are allowed to enter the system to correct the data after being authorized. At the same time, they are backed up in multiple blockchains to form historical records.

Traditional student status change process. If students want to transfer from one province to another, they should first apply, submit it to the head teacher for signature, and then submit it to the local education bureau for review after being approved by the school. After being approved by the Provincial Department of education, the student status information will be changed by the receiving Province, transferred to the provincial education administrative departments at all levels in turn, and finally reported to the receiving school for registration. In the whole process, the county-level Education Bureau is the first person in charge of examination and approval, followed by the prefecture level education administrative department. All information is collected in the education administrative department, and the school is the first person to apply for and manage student status, which can easily lead to corruption in the circulation process, inadequate management and supervision in the whole process, frequent college entrance examination immigrants, time-consuming accountability and weak traceability, Easy to imitate. 2005 was the year with the largest number of college entrance examination immigrants in Hainan Province, and one of every five Hainan candidates was college entrance examination immigrants; In 2015, there was a large migration of registered permanent residence in Inner Mongolia Autonomous Region, and college entrance examination immigrants by means of false student status or "empty student status"; In 2017, the most outstanding college entrance examination immigrants in Beijing history - Overseas Chinese students went to domestic first-class universities; In 2019, Fuyuan school in Bao'an District, Shenzhen was questioned as "college entrance examination immigration".

New mode of student status management. Student status is the object, and other information such as schools, teachers and educational administrative departments are managed as the attribute of student status. In the management of student status, the traditional centralized mode is changed to the blockchain mode. The student status information is divided into several blocks through the hash algorithm, and stored and backed up in the form of links. Teachers, schools and administrative departments can fully read the student status information, and can only fill in or improve some attributes of the student status year by year through asymmetric encryption algorithm. At the same time, the information is written into each block chain, and the number of attributes is limited for any unit or individual, so as to ensure the independence of work and realize the non tamper ability of the student status. Once the student status changes across provinces, it must be verified to ensure the authenticity of the student status. Otherwise, if it does not pass, it will not be transferred across provinces, which effectively prevents the modification of student status and realizes the immigration of college entrance examination.

3.3. Functional Features of Blockchain Technology in Primary and Secondary School Student Status Management

The student status management based on blockchain can realize accurate docking, accurate management and accurate tracking. The blockchain technology is used to encrypt, save and supervise the flow of data, so that the whole process information of learning, award, teaching and assistance activities and promotion and transfer student status management can be stored on the chain, which is convenient for supervision. All information can be guaranteed to be safe, credible, transparent, traceable, tamper free, transparent and efficient, and the behavior of relevant departments or individuals can be effectively supervised. The main functional features can be summarized into the following three points:

(1) Decentralize and establish mutual trust and supervision. Distributed storage is decentralization, which is also the most important and basic feature of blockchain. In the blockchain system, all data are open and nodes are transparent to each other. The information in the whole process of student status transfer is stored in the form of blockchain, which can be reviewed and tampered with, so as to enhance the trust and supervision of student status transfer.

(2) Open and transparent, fair and simple. In each circulation link, the data of student status is stored in a blockchain distributed chain, which is transparent, decentralized, traceable and tamper proof, so that every step of the circulation of student status information will leave a mark on the blockchain, such as teachers, schools The student status information provided and guaranteed by the competent education department and other units or personnel provides the ability to improve supervision, which can prevent corruption to a certain extent, and can be transferred directly after verification on the Internet, so as to reduce repetitive operations, reduce costs, and be convenient and fast.

(3) Accurately identify students. The anti-counterfeiting characteristics of blockchain technology are used to identify the authenticity of various certificates, random and anonymous investigation of students' families and other means and methods, so as to ensure the accurate identification of awards and assistance objects. Identify the source of blockchain, make full use of information sharing, trace through non variability proof, and then conduct big data processing and analysis, so as to accurately identify and manage awards and special funds.

3.4. Analysis and Design of Teacher Team Management

At present, the information management of teachers is led by the educational administrative department and highly intensive management. All the new information generated after the teacher's employment is collected again to the local competent education department, which becomes the final witness of the information. Every information such as teachers' academic

qualifications, academic papers, research projects, awards, skill level, continuing education and school evaluation results can be falsified. For example, the academic qualifications before 2002 cannot be verified, papers, periodicals and award certificates can be forged, and the skill level and continuing education can be directly charged or reissued after expiration, resulting in corruption, difficulty in verification. The cost of verification is high.

Information management with the help of blockchain technology and the establishment of public blockchain and independent blockchain can prevent data fabrication, false data storage and traceability. Store the teacher information in the form of blockchain and inject it into the teacher information. Each unit is a node in the blockchain. Write the information into the blockchain. Any other person or unit irrelevant to this information cannot rewrite any information in the block and copy each information to each block in Distributed Accounting. Only the individual or unit who obtains the private key can modify the corresponding block information. At the same time, the legal holding of the private key is guaranteed in the form of system.

Several public blockchains are established in the system. Only the Department with "write" permission can enter the information of the specified blocks in the blockchain through the private key. The Department without the private key cannot modify any information in the blockchain, and then save the modified blocks in the chain in the form of Distributed Accounting. Through the encryption of the private key to modify the information, it can effectively prevent illegal personnel from tampering with teachers' personal information, eliminate the possibility of forgery, and enhance the transparency and fairness of teachers' evaluation of professional titles and promotion. At the same time, it can further crack down on illegal and criminals and trace the source of criminal acts.

Through the management of teachers through the blockchain, the competent education department can fully grasp the teacher strength of each school, understand the standard of each teacher, and further balance the allocation of school teachers. At the same time, it provides reference for the recruitment of teachers. The school can also dispatch class information and adjust teachers according to the management information system, so as to make teachers moderately balanced in each class and promote the school management level to a higher level.

4. Questions

Blockchain is a new technology at present. At present, it has been applied in many fields. With the advancement of technology, algorithm optimization and exploration of new knowledge, any technology has certain vulnerabilities or other problems within a certain in-depth cognitive range, and blockchain is no exception.

First, security. Attack has always been the biggest security threat faced by all software. Blockchain is based on POW consensus protocol system. It can attack the network mainly by mastering a certain computing power. Although it is very difficult, the threat always exists. The second is anonymity and privacy. The nodes in the blockchain network are not explicit addresses, that is, they are not truly anonymous. They still need to give an address during data transmission, but this implicit address will lead to the inability to protect privacy. The third is the throughput and concurrency rate. For security, the blockchain system sacrifices performance.

In the whole process, signature, verification and block hash operation occupy a lot of system overhead. Each node runs as a P2P peer-to-peer network, and the design in the scenario of high concurrent service may not be comprehensive enough. Fourth, systematic efficiency defects. Because even if only one block is added to the main chain, the data of all nodes must be updated accordingly. When a large number of blocks are added to the main chain at the same time, it will not only cause the transaction speed of the main chain to be extremely slow, but also cause

the database capacity to expand rapidly. Fifth, data space storage. All block nodes in the network store the same data information. With the passage of time, the data increases day by day, resulting in the accumulation of data storage space to a certain order of magnitude. How to effectively solve it is also a severe challenge.

5. Conclusion

As a new contemporary technology, blockchain has been studied by many scholars at home and abroad, attracted extensive attention and gradually applied to all walks of life. For the field of education, at present, it mainly stays in the integrity management system of college student status, has not been vigorously expanded, and still has a broad potential value and mystery. Introducing blockchain technology into primary and secondary education information management is both a challenge and an opportunity. This paper studies and designs the primary and secondary education information management system based on blockchain, manages the primary and secondary school student status and teacher information by introducing blockchain, maintains the information of each node, prevents arbitrary tampering, and uses historical records to trace illegal acts, so as to further ensure the security of information and the convenience of information sharing, It promotes the open, transparent, fair and healthy competition between students and teachers, and improves the efficiency of scientific management of education departments at all levels.

References

- [1] Cui Ayue, Zhu Conghui, Wang Xinghao: Research on student information resource management system based on blockchain, *Network Security and Applications*, 1(2019), p.18-20.
- [2] Zhou Hongyi, Qian Weihang, Bai Jingjing: Typical application scenario analysis and project practice of energy blockchain, *Power Construction*, 2(2020), p.11-20.
- [3] Zhou Yihua, Li Hongming: Data management scheme based on blockchain, *Information Security Research*, 1(2020), p. 37-45.