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DELIVERING QUALITY SCIENCE TO THE WORLD

Research on the Application of Blockchain in Education

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Abstract: Blockchain is another major destructive technology after cloud computing, Internet of Things and big data. This article briefly introduces the blockchain. It has decentralized nodes that cannot be tampered with and data is reliable. This paper uses the literature to explore the sharing of educational resources in the field of education, the reliable recording of learning information, copyright protection and the application of educational contracts. Combining the characteristics of student information management system and the characteristics of blockchain, this paper designs a learning management system architecture with a unified learning interface and a common module architecture, which improves the shortcomings of traditional students' security and poor concentration. Manage the system and build scalability. A good, safe, non-tamperable, decentralized student management system.

Keywords: Blockchain; education; student management system; general architecture.

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1. INTRODUCTION

Since 2008, Satoshi Nakamoto published the concept of bitcoin, and based on this, after the concept of blockchain was put forward, the blockchain began to develop rapidly, especially during the two sessions this year. Blockchain + medical, blockchain + big data, blockchain + supply chain finance, blockchain + insurance, blockchain + smart city and many other blockchain + mode applications in the proposals of the two delegates Frequently appearing and being mentioned, it is clear that the term "blockchain" has become one of the hot topics of the two sessions. In fact, China's attention to this another disruptive technology, which is regarded as cloud computing, Internet of Things, and big data, has been published in 2016 from the Ministry of Industry and Information Technology's "White Paper on China's Blockchain Technology and Application Development". In this white paper, it is clearly stated that "the blockchain system data can not be falsified, the system is transparent and other characteristics have great advantages in college students academic, qualification certification, credit management." However, the current application of blockchain in education is still in its infancy. In foreign countries, the earliest MIT Lab of MIT has developed a certificate promulgation platform and a corresponding mobile app, while Holberton School It was the first university to combine blockchain and learning process records. The Badge Chain research team linked the blockchain to the release

function of the Digital Medal. In China, the research on the application of blockchain in education has just started. Only a few articles have been studied theoretically. The Central University of Finance and Economics has actually deployed it, but neither has given the clear structure and relative structure of blockchain technology + education. Complete application model.

2. INTRODUCTION OF BLOCKCHAIN

(1) Definition of blockchain

Blockchain technology (BlockChain) is a technical method to jointly maintain a high security database through decentralized and highly trusted methods. It is a chain of different blocks, each block contains the block header and the block body. The block header is responsible for connecting to the next block, which is responsible for storing data. When blocks and chains are formed, the system automatically generates a timestamp and time stamps the data information.

(2) The core technology of the blockchain

In the application process of blockchain, its core modules generally include four core technologies: distributed ledger technology, smart contract, asymmetric encryption algorithm, and consensus mechanism. The first is distributed ledger technology, which means that transaction accounting is done by multiple nodes. Each node can be in a different location, and each node has a complete set of accounts, so each individual node can participate. Supervise and testify to each other to ensure the reliability of the database. A smart contract is a pre-defined digital convention that is automatically executed at the time of the transaction. If the data of each node is true and reliable, the smart contract will be automatically executed under the supervision of the remaining nodes, but it should be suitable for the data structure on any blockchain. An asymmetric encryption algorithm refers to the use of a combination of a public key and a private key to solve the security problem. The transaction information stored on the blockchain is called a public key, and the account identity information for each user is a private key. Finally, there is a consensus mechanism. The consensus mechanism refers to how to judge whether the information is authentic. For example, most blockchains now use the concurrent Byzantine consensus protocol CBFT, which performs transactions in parallel with voting, if greater than 51%. The node considers that the data is reliable, and then determines to change the data to valid data.

(3) Characteristics of blockchain

It is precisely because of the structural characteristics of the blockchain and the core technologies it contains that the blockchain has the following obvious features: 1 No central node: Because the traditional database maintenance method is to store all the data in one. In the trusted third-party database, and the third party acts as the central node, the central node performs database maintenance. However, in the absence of a trusted third party, the data security problem cannot be effectively solved. Blockchain technology uses a peer-to-peer communication mechanism in which each node in the chain is equal and there is no central node.

2 Unchangeable: Due to the application of the consensus mechanism in the blockchain and the complete set of book storage mechanisms for each node, data modification of a single node or even several nodes (less than 51% of the whole) is meaningless.

3 Timing of data: Since the links are connected in a chronological order into a chain structure, the

different time stamps of each block make the data traceable.

4 Security: Due to the adoption of the encryption algorithm, the feature of having no central node and its irreversible modification makes the database maintained by the blockchain have high security.

3. APPLICATION IN EDUCATION

(1) Realizing the sharing of educational resources

There are two main applications of blockchain technology in resource sharing in the field of education. They are applications in online learning and applications in decentralized education. Because the development process of things is generally composed of three processes: “starting”, “generating process” and “resulting”. The decentralization of the blockchain is not through the process of changing its "starting" or "results", but merely the process of decentralization of the process. In the shared educational resources, the blockchain stores the information written by a single node into a plurality of separate nodes through distributed ledger technology, which facilitates the teacher to upload relevant information about the teaching, and the student can be at other nodes. In addition, the query has realized the sharing of resources. In addition, the blockchain is also incapable of modification, using independent timestamp verification on each piece of information to ensure the authenticity of the resources and the irreversible modification, thus maintaining the The rights and interests of the publisher. For example, in the application of postgraduate study abroad: due to the domestic and foreign information of the military, it is often difficult to obtain information about foreign universities in China. If the blockchain is used to build a non-tamperable and reliable information platform, it will be very convenient for domestic use. Students can find reliable information anytime, anywhere.

(2) Reliable record of learning information

In the society where academic fraud and resume fraud occur frequently, the record of learning information is very important for students and for employers. For students, Log in to the campus network to check the learning achievements in the course of learning. After the application is successful, the employer can also check the student's school award by logging into the campus network to verify the authenticity of the student's resume. The decentralization, inability to modify, and the characteristics of the distributed ledger of the blockchain show great advantages in realizing the above functions. Firstly, the distributed account book management database has achieved the effect of decentralization. This means that every change made by the teacher or student to the maintained database is supervised by other nodes, ensuring the reliability of the information. On the other hand, the use of distributed ledger technology allows each node to query all transaction information in the database, thus providing a great help for the multi-party authentication process. In addition, based on the distributed data record characteristics that blockchain technology cannot be falsified, each university can record the learning process and activity traces of each student in the school in real time, and then enter each student's grades into the database. It is almost impossible for others to change to avoid academic or informational fraud. Both of the above features of the blockchain provide great convenience for students to track their reliable information later in the year.

(3) Prevent copyright theft

As mentioned above, blockchain technology can be used in conjunction with a certificate authority

to establish a reliable certificate authority system. In the current society, the barriers between different universities have already been pushed by the platform of the MOOC, but because of the learning results of various online courses on the MOOC website, or the certificates issued are not recognized by the market, they are promoted. It has been greatly hindered. If blockchain technology is used, a credit bank can be set up to provide a low-cost reliable authentication system. In addition to this, the explosive growth of resources has undoubtedly adversely affected the copyright of resource owners. The inability to modify and decentralize the blockchain can solve this problem well. For example, in the moocs system, due to the structural characteristics of the Internet, copyright owners' copyright protection is greatly lacking. Therefore, I think that an academic copyright system can be established in conjunction with the blockchain. The basic principle is to set up each file. The only watermark, if other people use the file, there will be one more transaction record in the blockchain of the copyright owner.

(4) Build an education contract

Under the current educational model, the education contract is indispensable, whether it is the charging of educational resources for the teacher users and the acceptance of the students' successful learning, or the use of educational resources by the students, purchases, etc. It is necessary to participate in the education contract. However, the traditional education contract is costly and has poor security. If an educational intelligence contract is constructed in combination with the blockchain, it can greatly improve its security and facilitate the inquiry of the learning outcomes of student users in the future.

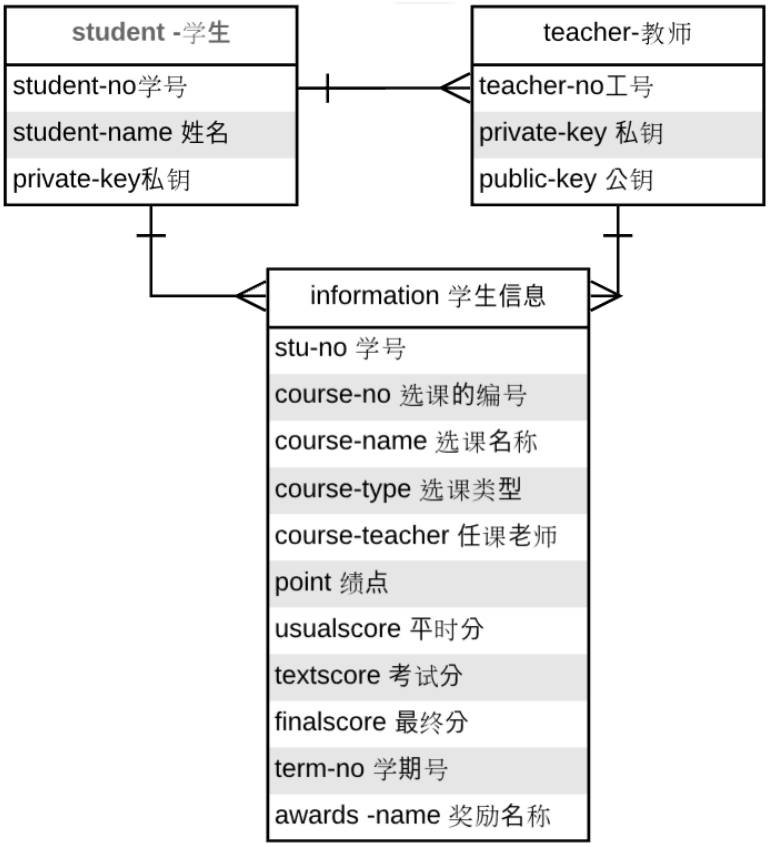

Figure 1 Entity ER diagram

4. BLOCK MANAGEMENT BASED STUDENT MANAGEMENT SYSTEM

(1) Student Management System Database

Based on the characteristics that the blockchain can not be falsified, high security and traceability, this paper proposes a student management system based on blockchain technology, in which students' performance information, reward and punishment information and course selection information will be stored. Trying to build an unmodifiable, traceable educational blockchain model. The database in this model contains three entities with the following attributes:

(B) The general architecture design of the system

Referring to the application of the blockchain in the financial field, the architecture of each module in the system can be divided into four layers: a storage layer, a blockchain service layer, a chain code layer, and an application layer. The functions of each layer are:

1 Storage layer: The storage location of the user data block, due to various requests from the user.

2 blockchain service layer: Since the block is created, time stamp, parent hash, and Merkle root are added to the created block. After the result creation block, the updates on the single node are synchronized to all the nodes on the blockchain, and the Merkle tree is updated at the same time.

3 chain code layer: use the private key sent by the user to decrypt and verify, if the user's permission can be performed after the verification, the next layer performs the operation.

4 application layer: Provide a visual program that can interact with the user, send the user's operation request to the next layer, and proceed to the next step.

(3) The core technology involved in the architecture

The encryption algorithm in the blockchain is SHA256; the public key and private key encryption use the elliptic curve encryption algorithm in cryptography; the consensus mechanism adopts concurrent Byzantine. SHA256 is a hash function, a method of creating a small digital "fingerprint" from any kind of data. The encryption algorithm generates a 256-bit long hash value for any long message, called a message digest. With this encryption algorithm, the security is the highest and the possibility of collision is small. The elliptic curve cryptography algorithm is used to create a public key cryptographic algorithm that uses a smaller key than other methods to provide a fairly even higher level of security. Concurrent Byzantine significantly reduces the number of participating verification and accounting nodes, and can achieve second-level consensus verification.

5. CONCLUSION

This paper first introduces the basic principle of the blockchain and its current application in the field of education. Then it designs a blockchain operation structure that conforms to the academic information management system. This architecture not only has the decentralization, tamper resistance, and anonymity of the blockchain. Characteristics such as sex, and reference to the application of blockchain in other fields, improve the scalability of the system. In the later stage, the system architecture design can be further improved on the basis of the student management system to adapt it to more educational information systems; in the future, the block structure should be optimized, the building block efficiency should be improved, and the stability of the blockchain system should be enhanced.

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