



Application of Blockchain Technology in Data Management of University Scientific Research

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Abstract. In the daily scientific research activities, the university will form a large number of files. The goal of data management of university scientific research activities is to ensure the availability, authenticity and validity of scientific research data, but the electronic data is more easily modified. There are problems in data security, storage security and utilization security of scientific research data. The blockchain technology is applied to the data management of scientific research activities, which can realize the management of the whole life cycle of scientific research data and ensure the effective use and security of scientific research data. SWOT analysis is helpful for university research managers to understand the real situation of research management. Therefore, this paper makes a detailed SWOT analysis of university scientific research data management, and proposes a data management system of university scientific research activities based on blockchain technology.

1 Introduction

Blockchain technology has the basic characteristics of distributed ledger, decentralization, asymmetric encryption, smart contract, information sharing and point-to-point transmission. Blockchain technology has attracted much attention in the public services of Finance and government. Digital data management of scientific research activities is the only way of development. Therefore, the security management of data of university scientific research activities should be the main content of scientific research management. However, the existing data security management of university scientific research activities has some risks such as data security and storage security. The fusion of block chain technology and university research activity data can effectively reduce security risks. Therefore, this paper will introduce the concepts and key technologies of data management of university scientific research activities and block chain technology. Combined with the development background of big data, this paper makes a detailed SWOT analysis on the management of university scientific research data, and studies the application of block chain technology in the daily management of scientific research data.

2 Data Management of University Research Activities

The management of university scientific research data should be to ensure the integrity, effectiveness and availability of digital data. It is divided into data security, storage security and utilization security. Data information security refers to the security of digital data, not to be stolen and destroyed. Data storage security refers to the information storage medium as well as the software and hardware system's safety, ensure that the electronic data is not being stolen and damaged. Utilization security should be refers to the digital data in the use of security and stability in the process of transmission. It will not leak.

3 The Concept and Characteristics of Blockchain

Blockchain is essentially a distributed database system. It has seven characteristics: open consensus, decentralization, non-cheating, anonymity, tamper proof, traceability and programmability. The open consensus is that each device can be involved in the blockchain network as a node. The decentralization refers to blockchain network composed of multiple nodes. Each node has equal status. There are no centralized devices in this network. The failure of one or several nodes will not affect the entire system network environment. The non-cheating mainly refers to the operation rules and block chain node data is open and transparent. Trusted interactions can be achieved by following established rules without creating trust relationships in advance. Non-tampering refers to the verification relationship between the blocks in the entity blockchain system. If you want to tamper with the data of a block, you should change the block and all of its subsequent block data, and you should do so within a certain time of the consensus mechanism. By means of blockchain technology, the system can record all the registration data and ensure the authenticity and traceability of the records. In addition, all data in the blockchain are extremely difficult to be destroyed due to the distributed storage, which has the characteristics of decentralization, non-tampering, traceability and security.

4 Feasibility Analysis of the Application of Block Chain Technology in Data Management of University Scientific Research Activities

In the SWOT analysis of university research data management activities, S, W, O and T respectively refer to the advantages and disadvantages as well as the opportunities and threats faced by the application of block chain technology in these activities under the background of big data. When block chain technology is applied to SWOT analysis of university research activity data management, different investigation methods can be adopted. Questionnaire can be used.

4.1 Strength Analysis (SA)

4.1.1 Mature University Information Network Construction

At present, China's network construction continues to improve, and the universities have their own mature network environment, and there are specially-assigned person responsible for the information construction of scientific research activity data management. In this network environment, when the school conducts scientific research data management activities, the network can support the network connection requirements of computer-related equipment and related mobile terminal equipment. Therefore, all kinds of users in the university can find the Shared information anytime and anywhere. Therefore, cloud storage and cloud utilization of scientific research activity information can be realized.

4.1.2 Improvement of Electronic Database

Traditional scientific research data management activities have a high dependence on paper archives. Under the condition of the current data scale expands unceasingly, university departments produce a large number of documents, and form a corresponding scientific research data. Data storage and processing are put forward higher requirements. Therefore, the scientific research data management researchers began to actively to upgrade data management system, and build more and more perfect electronic database. Under the informationization way of data processing, electronic database can avoid the damage of documents in the traditional data management process, and can accurately and timely carry out automatic modification of data information. At the same time, electronic database also shows many advantages in the aspects of document filing, classification, sorting and retrieval, and can largely promote the quality of the university scientific research data management activities.

4.2 Weakness Analysis (WA)

At present, most universities have not paid enough attention to the information construction of scientific research data management, so there are still many problems in the construction of data management system. Due to the lack of attention to data management, there is a lack of investment in data management, and there is a lack of standardization in management process and management system. Under the weak consciousness of scientific research data management in universities, many universities have serious problems of scientific research data management decentralization, which will have a negative impact on the integrity of data information content and may cause a large number of human and material resources waste.

4.3 Opportunity Analysis (OA)

First, the blockchain technology can ensure the authenticity of the data. Block chain technology adopt distributed ledger, digital signature and digital time-stamp and other technical means. Such technology enables all nodes in the network to jointly maintain the same distributed data and ensures that digital data is not tampered with or deleted.

Second, blockchain technology can ensure the security of data. All attacks on data in the network will be recorded and traceable. When data is transmitted in heterogeneous system, asymmetric encryption algorithm and digital timestamp are used to ensure the security of digital data transmission.

4.4 Threats Analysis (TA)

The application of blockchain technology can facilitate the whole life cycle management of digital data. Block chain technology can connect electronic data into a distributed network from business departments in various links such as formation, filing and management. This technique integrates all the operational data and metadata of the data into one whole and maintains the comprehensiveness of the electronic data. In this case, the trust “intermediary” role of management is no longer substantive. The responsibility of receiving management will be replaced by blockchain technology. Automatic transmission is realized under blockchain identity authentication and smart contracts technology.

5 Application of Blockchain Technology in Data Management of University Scientific Research Activities

The traditional scientific research management system can be divided into the following modules: data collection and arrangement of scientific research activities, data utilization of scientific research activities, and basic data management module. The collection and collation of the data management of university scientific research activities include the basic functions of input and collation of activity data. The utilization of university scientific research activities includes inquiry, statistics, audit and other functions. Basic data management includes user management, role management, permission configuration, basic data configuration and other basic functions (Fig. 1).

The basic idea is to learn from the common concept of block chain technology and chain organization method, to solve the problem of “data tampering” and “untrustworthy custodian” in information data management, and finally generate the blockchain [1].

By introducing the technology of blockchain, the data generation institutions, administrative departments and management departments of university scientific research activities are all involved in the process of updating and maintaining the data status of university scientific research activities. A distributed registration network for university research activities will be established. Each node in the network keeps a good copy of scientific research activities. The generated data of each scientific research activity is organized into blocks, which are linked to each other. Each block is based on the digital data generated by the current scientific research activity. The electronic data is encrypted by the digital data producer, supplemented by the time stamp generated by the data, the digital signature of the participants and the check code index of the last scientific research activity block, as well as the check code of all the above contents. If you want to modify the information of this scientific research activity, you need to obtain the consent of all other network nodes. Therefore, it can

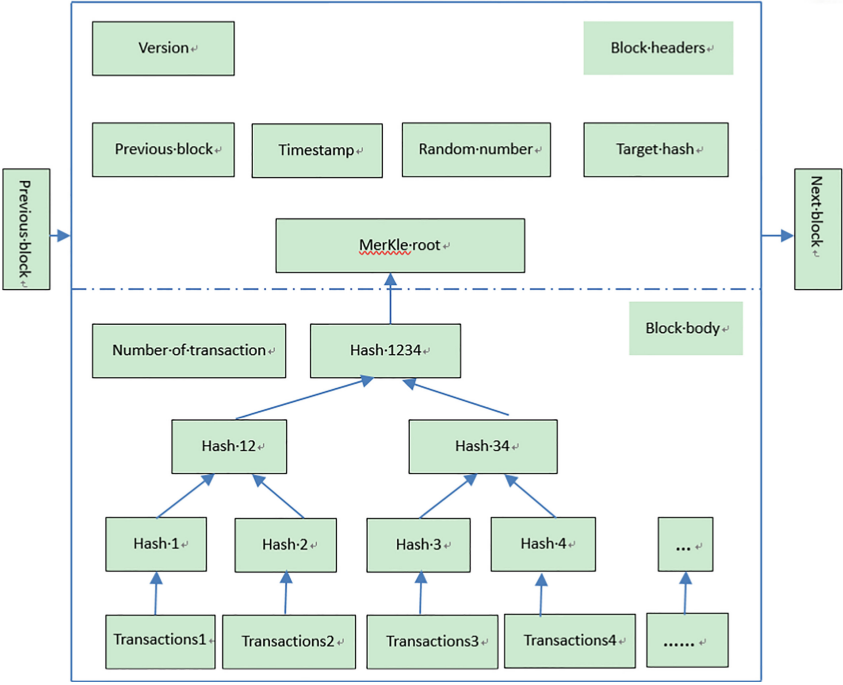


Fig. 1. Block chain structure

reduce the data security problem caused by single node network attack and improve the security of university scientific research activities.

The whole review process of scientific research activities shall be reformed according to the following steps: (1) The front-line staff of scientific research will draft and encrypt the documents of scientific research activities, and then submit the resulting electronic documents to the department management. With the help of time stamp and signature, the first block and check code of scientific research activity are generated. (2) According to the submitted electronic documents of scientific activities, the department management gives format review opinions and encrypts them. Together with the staff signature, time stamp and the first block check code index, a new block and its check code are generated. The new block and its check code follow and point to the first block. If the scientific activity document is modified during the format review, (1) and (2) the process may add blocks repeatedly until this document can be submitted for review. (3) On the premise that the documents of scientific research activities pass the format review, the expert committee gives the review opinions according to the documents of scientific research activities. This electronic document is encrypted. With the signatures of all the members, staff and front-line staff of scientific research attending the conference, as well as the timestamp and the check index of the previous block, the new block and its check code will be generated together. From this process node, all check codes of the relevant area chain are submitted to the university scientific research management institution. (4) During the follow-up scientific research activities,

the university’s scientific research management institution and the expert committee will continuously construct new research activity follow-up audit blocks by providing documents such as relevant reports, time stamps and indexes. When the scientific research activity is terminated or suspended, all the electronic document data generated from the termination or suspension will be generated into the final block. This block is also contained with participant signatures, timestamps, and indexes (Fig. 2).

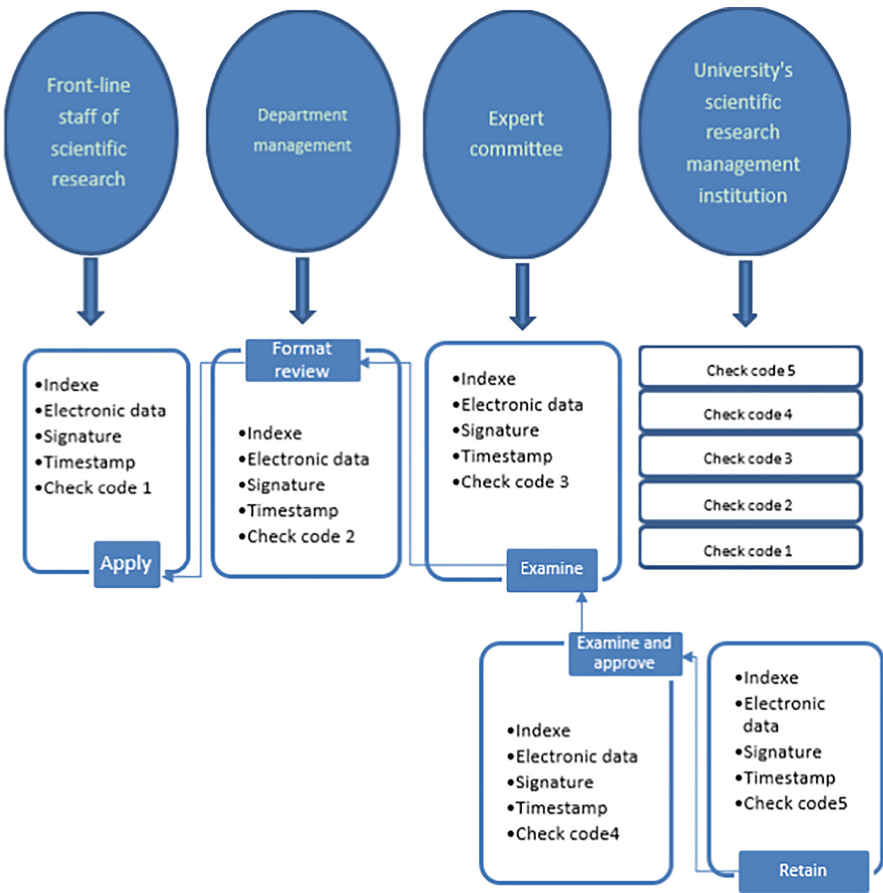


Fig. 2. Business process diagrams

5.1 The Application of Blockchain Technology in Collecting and Organizing University Scientific Research Activities

The data of scientific research activities is an important basic information for the management of scientific research institutions. However, illegal change of data on scientific research activities still occur [2].

In the data management of university scientific research activities, the functional departments, departments and other relevant units of the government combine in a network platform of scientific research activities. The relevant units of this platform agree to record the individual's scientific research experience and assessment performance through the blockchain after confirmation. In other words, personal scientific research activity data that cannot be tampered with and can only be supplemented with new information is established on the platform.

5.2 The Application of Blockchain Technology in Data Utilization of University Scientific Research Activities

The applicants who use the data of scientific research activities can be divided into two departments: the data generation department of scientific research activities in the University and the non scientific research activity data generation department in the University. In the information management system of scientific research work based on blockchain technology, the data of scientific research activities is formed and maintained by colleges and scientific research data management department. Therefore, the data generation department of scientific research activities can directly utilize the data. For the data generating departments of non-scientific research activities, an application for data utilization should be initiated. Firstly, the applicant shall be authenticated, and then approved by the research activity data generation department and the research activity data management department. Then the system generates the access public key corresponding to the digitized data of scientific research activities. Finally, the applicant uses the public key to exploit the data [12].

6 Conclusions

The application of blockchain technology in the data system of scientific research activities can realize the whole life cycle management of the scientific research activities and ensure the true integrity of this scientific research activities. The way is great significance of the national scientific research management. How to apply blockchain technology to a wider range of scientific research activities management system. It's still needs further exploration and practice. If we can use the power of Internet of things, 5G and other new technologies, we believe that new application research space will be created in the future [13].

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