Exploring the Architecture of Online Education Platform Supported by Blockchain Technology: Taking the Chinese University MOOC Platform as an Example

Jingjing Su and Yonghong Wu[(✉)]

School of Educational Technology, Northwest Normal University, Lanzhou, China
`3130353770@qq.com`

Abstract. In the current era, the development scale of online education is expanding, but the rapid development has exposed many drawbacks. As another disruptive technology after big data and cloud computing, blockchain technology has a strong feasibility to effectively solve the problems in online education platform architecture. This study will take the MOOC platform of Chinese universities as an example, combine the integration and application of blockchain technology, and further explore the realistic path of realizing convenient teacher and student qualification authentication, sharing of high-quality teaching resources, and digitalization of teaching evaluation system based on the existing architecture. It will optimize the utilization system of online education platform, realize efficient transmission of online teaching resources, and effectively improve the service quality and level of online education.

Keywords: blockchain · online education · MOOC

1 Introduction

From a technical point of view, the rapid development of online education is no accident. The more traditional large-scale online education (MOE) has decades of development so far. The emergence of cloud computing, Internet of things, big data and other emerging technologies has promoted the reform of the online education model. Chinese university MOOC platform is a typical representative of China's online education platform. Professor Sun Maosong of Tsinghua University believes that the construction of MOOC platform and the reform of education mode should be viewed not only from the perspective of education, but also from the perspective of technological research [1]. Only by making full use of new technology and constantly improving, perfecting and innovating the online education platform, can we better serve the education. Blockchain technology is a technical solution to collectively maintain reliable databases in a decentralized and high-trust way, which is widely used in finance, Internet of things, logistics, insurance and other fields. It is understood that the research on the application of blockchain technology in the field of education at home and abroad is still in its infancy, and a

small number of educational institutions have actively explored it [2]. Taking the online learning platform of national high-quality courses of "Chinese University MOOC" as an example, this paper will explore a new mode of integration of blockchain technology and online education platform on the basis of the existing platform.

2 Feasibility of Blockchain Technology to Support Online Education Platform Architecture

The theoretical foundation of blockchain security can be traced back to 1976, when Diffie and Hellman, two cryptographic masters, explored the concept of a mutually distributed ledger in their article "New Directions in Cryptography" [3]. 2001, the US National Security Agency released the SHA-256 algorithm, which provided an important technical support for the birth of blockchain [4]. In 2008, Satoshi Nakamoto first proposed the concept of "blockchain" in his article "Bitcoin: A Peer-to-Peer Electronic Cash System". The feasibility of blockchain technology to support online education platform architecture is reflected in the following aspects.

2.1 The Inevitable Trend of Online Education Development Under the Development of the Times

With the development of the times, blockchain has been actively promoted and applied in many industries because of its five important characteristics: decentralization, openness, anti-usurp modification, anonymity and traceability. In the field of education, as online education continues to develop, human learning presents increasingly diverse decentralized features such as digitalization of modes and sharing of resources, diversification of contents, equality of education, and decentralization of places. Professor John Domingue, director of the Center for Knowledge and Media Studies at the Open University in the UK, believes that blockchain technology and intelligent contracts will give birth to an increasingly decentralized new learning model and lead to new learning changes [5]. With the development of the times, it is a general trend to optimize and upgrade online education platforms by applying various new technologies, and the construction of online education platforms supported by blockchain technology is an inevitable trend in the development of online education.

2.2 The Need to Change the Traditional Teaching Model

The traditional teaching model has oneness and limitation in teaching time, place, method, teaching content and teaching evaluation method. This model ignores the differences of knowledge level and learning characteristics between different teaching objects, and cannot teach students in accordance with their aptitude. Because of breaking the limitation of time and space and having massive teaching resources, online education is increasingly accepted by the general public. In order to put "student-centered" personalized teaching into practice, it is necessary to create a more optimized online education platform. By creating a blockchain of learning records with an online education platform, we can realize a variety of learning records, such as formal learning, informal

learning, and online learning, as well as support other online and offline or hybrid learning activities. The new online learning platform supported by blockchain technology breaks the traditional time and space limitations of teaching, provides rich and diverse learning resources, and conducts various forms of academic evaluation, which is more conducive to improving teaching efficiency.

2.3 Blockchain Technology Can Support Further Optimization of Online Education Platforms

With the continuous penetration of blockchain technology in the field of education, blockchain technology has become an important technical driver of change in the field of education [6]. The online education platform supported by blockchain technology is a new type of education platform formed by using the new technology to deeply integrate the innovations of blockchain with online education and change the education operation mode of conventional online education platform. The embodiment of this "new" is mainly focused on the data level, transaction level, application level and institutional level. The data level is mainly reflected in the creation of a traceable large database, the collection and processing of academic credit data, the realization of academic data records, sharing, etc.; the transaction level will create a safer transaction environment, the use of intelligent transactions Taobao, complete point-to-point transactions, automated transactions, etc.; the application level will build a convenient and fast online education platform, the integration of a new education resources system, education learning system and education management system, and ensure that these system and education management system, and ensure the efficient operation of these systems. The institutional level will create a decentralized online education platform that supports the operation of distributed education, open education, connected education, and other methods [3]. In general, the online education platform empowered by blockchain technology will fully reflect students' main status and create a more advanced online learning space.

3 Online Education Platform Architecture Supported by Blockchain Technology

The "China University MOOC" online education platform is one of the largest online learning platforms for national quality courses in China. According to incomplete statistics, there are 450 educational institutions that have opened China University MOOC accounts, which are divided into three categories according to the nature of the courses: university, further education/career selection, and lifelong learning. Among them, they are divided into computer, foreign language, psychology, economics and management, education and teaching, law, agriculture, forestry and horticulture, sports, music and dance according to subject types. The number of courses offered by the platform is up to more than 9,200.

3.1 The Design Concept of MOOC Platform

MOOC curriculum design comes from Massive Open Online Course, and the design of the platform is based on the concept of this model. Massive means unlimited expansion,

large-scale, designed to support large-scale learning population and teaching resources; open, designed to open to time, space, environment and learning identity, can break the limitations of time and space, anyone can log in to learn from anywhere, not limited by the network environment and platform; Online means good online experience, learning, communication and feedback will be carried out online; Courses means quality courses [7].

3.2   MOOC Platform Architecture Principles

According to the design concept of the model, the design of the platform should follow the following principles: first, it can support a large number of registered students and teachers; second, it has good sharing, supporting a large number of users to learn online at the same time; third, the system responds quickly, ensuring a large number of users to learn online at the same time; fourth, the network transmission stability, network technology must ensure that at any time can be logged in; fifth, global user login Fifth, global user access, reflecting openness, anyone, anywhere can login; sixth, can support a variety of terminals (especially cross-platform mobile terminals), any browser, etc.; seventh, high security, to ensure the integrity of system resources, confidentiality and availability, especially the security requirements of student course results and certification evaluation results.

3.3   Architecture Module Design

The structure of online education platform should be based on the relevant principles and theories of pedagogy. How does the online education platform give full play to its educational value? First of all, we have to consider the participation of educators and learners and how managers manage. The construction of Chinese university MOOC platform is also from the perspective of educators, learners and administrators. For educators, the online education platform bears the function of carrying and disseminating teaching resources; for learners, it plays the role of educators. In the whole process of education, the online education platform is the bridge and link between educators and educates. The online education platform built by using blockchain technology can better serve educators and learners.

3.4   Online Education Platform Architecture Strategy

3.4.1   Faculty and Student Qualification Authentication Using the Traceability and Tamper-Proof Features of Blockchain Technology

China University MOOC platform has 450 universities participating at present, which requires a large number of teachers, students and administrators to be authenticated and thus open the corresponding authority for related operations. How to effectively manage the large amount of authentication information is also a major problem faced by online education platforms. Blockchain technology is a clever solution to this problem. Using blockchain technology, the ID data of the relevant subject is stored locally in the user, while the data fingerprint information is stored on the blockchain. The data fingerprint

on the blockchain is controlled by a private key, and only the user holding the private key has the right to modify it [8]. This can prevent malicious use of other people's ID card scanning and uploading, and ensure the authenticity and non-tamperability of the subject information. Blockchain technology can also be applied in banks, relevant academic websites and other institutions to link various information of teachers and students on the chain to prevent behaviors such as academic forgery and moral risks of teachers and students.

3.4.2 Use the Decentralized Feature of Blockchain Technology for Sharing High-Quality Teaching Resources and Protecting Research Achievements

The biggest feature of blockchain technology is decentralization. The use of this distributed accounting rule allows all data information to be recorded on decentralized nodes, which theoretically realizes data self-proof in data transmission, and finally realizes the secure storage of the system and the non-repudiation of data. In the technical setting of block chain, information access control mechanism and review mechanism are set up to ensure the security of information transmission at the same time. This will mainly make use of timestamp technology and asymmetric encryption technology, effectively use public key and private key for data transmission, effectively share resources, and at the same time increase the difficulty for criminals to crack keys and ensure information security. At the same time, in the process of information transmission, all the access information of each system node is judged and the access authority is reviewed. In this way, the relevant access information and access records of the users are recorded on the node, and the visitors are supervised by everyone in the decentralized account book, which will effectively prevent the scientific research achievements from being stolen and tampered with.

3.4.3 Learners' Learning Behavior Tracking Based on the Traceability Feature of Blockchain Technology

In a blockchain-powered online education platform, learners' learning will be accurately recorded in nodes, encrypted, and presented to a multi-node ledger. This approach allows them to track their learning and monitor their learning at the same time. In addition, through the blockchain data sharing function with the employer, the employer can also collect the learning situation of the applicant directly through it, so as to make a screening.

3.4.4 Using Blockchain to Build an Online Education Quality Evaluation System

The online education quality evaluation system with the blessing of blockchain technology can establish a multi-agent private chain to evaluate the participants from the aspects of study, life, activities and so on. Establish an alliance chain among these nodes to open up the data islands between each private chain and connect the data together. The alliance chain is a multi-agent block chain model, and its information can not be tampered with to ensure the accuracy of the main evaluation data. Through the creation of an intelligent contract system on the alliance chain, all the data and information of quality evaluation follow the established model, actively and timely generate quality evaluation

conclusions, and timely transmit them to students, employers and other parties, so as to form a high-quality and efficient teaching quality evaluation system.

4   Conclusion

However, because of the complexity of education itself, there are also a series of challenges in the use of blockchain technology, such as difficulties in educational application and promotion, fuzzy property rights of teachers' teaching data, limited space for teachers' data management and teachers' information security risks. Although blockchain technology has been tried out in the field of education, this emerging technology is still in the stage of development. At present, many scholars have also proposed that the online education system supported by blockchain technology has not yet reached the integration stage, so the application of blockchain in the field of education remains to be further explored. At present, there is little practical experience of blockchain technology in the field of education, and there is still great resistance to its popularization and operation. Therefore, it is expected that our country will issue laws and regulations on the application of blockchain technology in the field of education as soon as possible, and properly handle the benefit distribution between traditional educational management institutions and operating platforms. Learn from the advanced experience from the international standardization system of blockchain to further promote the development of online education in China.

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