Blockchain Technology in Open University Distance Open Education

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Abstract. For distance education, the application of computer network and software technology is very important to open teaching and management. This paper mainly studies the application of blockchain technology in the field of Open University distance education. Blockchain technology, as a new type of decentralized trust structure technology, provides necessary support for distance open education in teaching resource utilization, teaching process control, teaching effect evaluation and teaching management, and provides an effective foundation for teachers and students to participate in distance teaching practice together. This paper adopts a hierarchical network architecture and hierarchical storage structure, which has good scalability and node transparency, provides support for user service strategy in large-scale applications.

Keywords: Blockchain Technology, Open University, Distance Open Education Field, Wireless Network

1. Introduction
Education is an eternal theme in the development of human society. With the coming of learning society and lifelong education society, the popularization, networking and virtualization of Higher Education under the background of knowledge economy put forward more requirements for education. The data of each stage in the process of data analysis is shared through the shared account book of the blockchain, and the data of each stage is uploaded to the account book.

Blockchain technology makes Internet of things data have a new transaction mode [1]. The biggest advantage of blockchain is that it can conduct transactions in trust. Users can directly conduct data transactions through smart contract terms without human intervention, which greatly improves the efficiency of data utilization [2-3]. As a new type of trust structure, blockchain decentralization technology has brought a turnaround for many industries that used to build trust structure based on centralization [4]. When the trigger conditions are met, the smart contract will read the corresponding data and calculate according to the preset logic, and finally store the calculation results in the chain structure permanently [5]. The use of virtual reality technology provides more convenient conditions for remote network teaching to simulate the real learning environment, provides necessary support for the virtual simulation of classroom education at this stage, and provides a new teaching mode for the specific implementation of teaching activities [6-7]. The huge amount of data generated at the edge
end is uploaded to the cloud for processing, and then the processing results are returned from the cloud, which not only wastes a lot of network resources, but also consumes a lot of time, causing a lot of network delay [8]. The reform content mainly includes the content, method and purpose of teaching. Among them, the important index to evaluate the effect of teaching reform is the status and role of each element [9-10].

In the real production activities, with the diversification of competition and the acceleration of information technology change, the uncertainty factors in the supply chain are increasing, and new technologies and methods are urgently needed to solve the increasingly complex supply chain problems. With the rapid development of the Internet, digital content presents an explosive growth trend. The openness and digital characteristics of digital content make it easy to share and transmit among network users.

2. Open University Distance Open Education

2.1 Blockchain Technology

When applied to the supply chain financial business, new information is entered into the blockchain platform and added to the end of the blockchain in chronological order. Blockchain uses this form to store supply chain financial information safely. In addition, the hash value is unique and unforgeable. If you want to check whether the data block in the supply chain is true or tampered, you only need to compare the two hash values. Blockchain technology can make all participants in the supply chain no longer rely on the central processing node and trust each other, and no longer need trust companies and other third parties to share the financial risks in the transaction. In this mode, any participant in the supply chain can assume the role of a central node, and each participant has a distributed ledger that records the information of all traders. Through this distributed ledger, any participant can obtain the information it needs without the verification of a third party.

The calculation formula for resource utilization rate \( \gamma_d \) is:

\[
\gamma_d = \frac{C^d_m - C^d_p + A_d}{C^d_m} = \frac{C^d_m \cdot \gamma_d + A_d}{C^d_m}
\]

(1)

A data center with N resources has M subtask requests, and the number of tasks allocated to each resource is J. The time span \( time\_cost \) that the data center needs to complete the task is expressed as:

\[
time\_cost = \sum_{j=1}^{m} (\max(t_{wa} + t_{pr} + et_{ji}))
\]

(2)

According to the usage rate of the above three sub-indexes, the usage rate formula of the virtual machine resource node is as follows:

\[
V_{of} = \left( \frac{k_1 \sum_{j=1}^{m} (al_{ji} \cdot C_j)}{V_{ej}} + \frac{k_2 \sum_{i=1}^{m} (al_{ji} \cdot M_i)}{V_{mj}} + \frac{k_3 \sum_{i=1}^{m} (al_{ji} \cdot N_i)}{V_{nj}} \right) \times 100\%
\]

(3)

2.2 Distance Open Education

The construction of modern distance education learning support model must be based on a certain theoretical research, and the relevant theories of many disciplines such as psychology, philosophy, distance education and educational technology have an important supporting role in the research of learning support. The real teaching process is actually the joint participation of teachers and students in the practice of a certain field. In this group of teachers and students, teachers are only more familiar
with this field, and can more proficiently reveal its mysteries and evaluate its value. Teachers and students are united by the same enthusiasm, striving for a common goal. In modern open distance education, the formative assessment of students is an important link in the whole process of teacher guidance and student learning, and it is also a formative evaluation of modern open distance education. The combination of formative assessment and regular face-to-face tutoring promotes student learning behavior.

3. Open University Distance Open Education System Experiment

3.1 Test Environment
The environment that this system mainly relies on is as follows: the operating system is Windows 7, the blockchain network is Ethereum, the development language is the Solidity language for the smart contract part, and the front end uses the Java Script language and HTML language.

3.2 System Test
Question bank management provides functions such as question bank browsing, searching, adding, deleting, modifying and updating test questions. All these functions are realized based on the Web page, so it has the characteristics of remote operation and easy to use. The system implements two online testing methods, the first is the students' usual practice. After learning the content of each chapter, students can connect to the system server through a browser, and then select the type of question they want, difficulty and other parameters, and the system will group papers and output according to the corresponding conditions in the background database. question.

4. Discussion

4.1 Performance Analysis
In order to meet the needs of modern distance open education, the construction of student learning support service system should adhere to the principles of rich media resources, diversified learning guidance forms, autonomous learning methods and standardized management services, meet the learning needs of all students and the requirements of teachers' teaching guidance, focus on solving students' confusion about the nature of learning, and make students understand the management process, help students design study plans. Through the feedback mechanism, it is helpful to find the interference factors that affect the implementation and quality of learning support in time. On the one hand, the influence of these factors can be continuously suppressed and eliminated in the implementation process, on the other hand, the learning support strategy can be adjusted in time to ensure the benefit and quality of learning support. The data owner will access the data that he owns, at this time, the system will use the virtual blockchain node to pipeline code the data to recover the data; for the data that has not been accessed for a long time, that is, cold data, it needs to go through two processes of coding and transmission; for the hot data, there is only one process of data transmission. The experiment tests the 10 times access time of a single file with different sizes, and the results are shown in Figure 1. It can be seen from the figure that for the same cold / hot data file, the access time increases with the increase of file size, and the increase rate increases with the increase of file size; for the same file, the average random multiple access time is slightly greater than the access time of hot data.
The average selection time of the system is shown in Figure 2. When the number of samples is relatively small, it may contain more hot words, and the search results obtained in the old system are more, so it takes more time to select; when the number of samples is increasing, the probability of hot words and unpopular words tends to be average, reflecting that the time to select from the search results is relatively reduced. Most of the positioning errors of the 20 Tags to be tested are about 0.4m, and the maximum error is 1.1m. Due to the large gap between the errors, it can be seen that the results of k-nearest neighbor algorithm are generally small, and the performance is not stable, which is mainly caused by 10dB noise. When training 40000 times, the mean square error is about 0.005, which is far less than the mean square error of 0.02 when training 500 times. In addition, the reputation scoring mechanism is introduced in the blockchain network. Since the master node of the blockchain network is the node with the highest reputation score in the network, the probability of error of the master node in the blockchain network is reduced, and the situation that the slave node usually needs to go through a round of invalid decisions when the master node makes an error is avoided. The average user waiting time of the two algorithms decreases with the increase of available bandwidth, and the average user waiting time of the improved algorithm is less than that of the periodic patch algorithm in the case of limited resources.

Figure 2. Comparison of the average selection time of the system

4.2 Throughput Analysis
With this distributed accounting method, any transaction information different from most nodes in the network can be excluded, and these information cannot be recorded on the blockchain. In the future, the large-scale system of school teaching mode will turn to more innovative and student-centered personalized teaching. The ideal of individualized education and individualized education that we have been pursuing will be realized with the support of artificial intelligence technology. The weight and activation value of the original 32-bit floating-point number are converted into 8-bit fixed-point value by parameter quantization. The quantized 8-bit fixed-point number parameters can not only reduce the storage space of parameters, but also need less resources in hardware and have higher running speed.
compared with floating-point number operation. The model is compressed by channel clipping and parameter quantization, and the parameter is reduced to 6.67% of the original model. Blended learning, which combines face-to-face teaching with online learning, becomes easy to implement. In the process of becoming a helper, promoter, instructor and consultant of learning, teachers' ability as experts in specific fields can be reflected in these activities and can bring real help to students' learning. The system test results are shown in Table 1. After the training, the neural network is tested with 100 sets of data from the test set, and two tags are located incorrectly, with an accuracy of 98%. It can quickly match the interest model of the educated with the hyperlinks of the web page, and easily modify and refine the interest model of the educated. In this way, the complexity of the algorithm is small, and the speed of the educated will not be affected.

5. Conclusions
This paper adopts a hierarchical network architecture and hierarchical storage structure, which distributes the file server, video file server and management server to multiple levels of the network. It has good scalability and node transparency, and provides support for user service strategy in large-scale applications.

This paper introduces pipeline coding scheme on the basis of double-layer blockchain to realize decentralized storage of data. Pipeline coding scheme can make full use of the characteristics of transaction format and communication content on virtual chain to transfer coding and decoding work to virtual chain nodes, so as to realize the high coupling between blockchain and data storage coding scheme.

This paper uses the form of ontology reasoning to construct the curriculum knowledge system, which is conducive to the standardization of curriculum knowledge expression, and can clearly show the knowledge points and the complex relationship between knowledge points.

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