



Application Research of Blockchain Technology in Art Trading Platform System under Cloud Computing Environment

Yuan Zhou^{1, *}

¹*Xi 'an Academy of Fine Arts, Xi 'an, 710065, Shaanxi, China
13004@xafafa.edu.cn*

Abstract

The distributed database established by blockchain technology ensures that the transaction information of all high-value artworks can be correctly reflected on the Internet and can never be changed, thereby gradually accumulating real artwork transaction data. The main purpose of this paper is to study the design and application of blockchain technology to the art trading platform system based on cloud computing. Based on the idea of PEST analysis method, this paper analyzes the background of blockchain art transaction. Under the premise of studying the operation mode and system of art trading, this paper comprehensively uses the latest domestic and foreign blockchain technology, art trading theory and transaction management and other related theories, systematically analyzes the characteristics of blockchain art trading, and analyzes the characteristics of blockchain art trading. Finally, a variety of expressions are used to visually display the trend graph of the research results of the application of blockchain technology in art trading to users. Experimental research shows that my country's art market has maintained a growth rate of more than 20% from 2005 to 2007, but due to the financial crisis in 2008, my country's art transaction volume has declined. According to the physical model of the blockchain art trading platform and related experimental test data, the average transaction execution time is about 17 seconds.

Keywords: *Blockchain Technology, Artwork Trading, Node SDK, Cloud Computing*

1 INTRODUCTION

With the rapid development of China's blockchain technology, the application of blockchain technology in art trading also develops. From the perspective of China's relevant regulations and the status quo of art market, blockchain art exchange has broad development prospects [3] [9]. This is also the reason for the rapid development of block chain technology in various regions of China in recent years [6] [10]. With the massive application of cryptocurrency based on blockchain technology, it has proved that blockchain is fair, transparent, effective and reliable [4] [7]. The function of blockchain technology storage includes smart contract and other applications, which makes it transparent and contract execution automatic [1] [2].

In the research on the application of blockchain technology in art trading, many scholars have studied it and achieved good results, such as Sikorski J J research points out that the blockchain technology combined

with cryptography encryption technology records digital assets in the bottom account books. Since its inception, the seamless and increasing transaction data can be transferred between different holders and recorded in the account books through the public and private key signature encryption and decryption method, and the transaction data can be written into the data block regularly or quantitatively according to the time sequence, and then the transaction data can be transmitted. It is confirmed by the verification procedure. The newly verified blocks will be attached to the previously verified blocks to form blockchain account books, and the network nodes composed of all participating members will maintain, store and ensure transaction records cooperatively. These digital assets cannot be used separately from the account books, that is, they cannot be traded off the chain [8]. This kind of recording method is the concept of distributed ledger, which can make the data unable to be modified unilaterally and can check the whole process of the data at any time. Launer J believes that blockchain

technology, like the Internet, will develop and rise rapidly in the future [5]. At present, for the application of blockchain system, the technology is not perfect, because blockchain needs large-scale cooperation and multi-party participation, and it also needs to form subversive technology, all of which need a development process. When the blockchain technology matures, its impact is immeasurable.

In this paper, according to the change of people's attitude towards art in the early 21st century, we conducted a relevant survey, consulted the relevant data, and finally sorted out the relevant data. Then, we conducted a simulation test according to the theoretical basis and application characteristics of blockchain, improved the trading platform of blockchain, and finally tested the system.

2 APPLICATION OF BLOCKCHAIN TECHNOLOGY IN ART TRADE

2.1 Cloud Computing and Blockchain

2.1.1 Cloud Computing

As a paid service, cloud computing requires users to purchase corresponding cloud computing services on demand on the premise of fully evaluating their own conditions. Cloud computing abstracts data computing, data storage, network transmission, hardware devices and other resources through key technologies such as virtualization, distributed parallel processing and the Internet, and then dynamically provides these resources to users on demand. This provides a more flexible, convenient and economical way for users to dynamically obtain computing resources and storage resources according to their needs. For users, rather than purchasing and maintaining a huge and expensive infrastructure and bearing huge expenses, it is obviously better to lease the necessary cloud computing resources and storage resources dynamically and expansively according to their needs. In this way, users can not only avoid the early investment risk, but also avoid the failure of resources to meet the demand in time due to the increase of the company's size, which is very attractive to small and medium-sized enterprises, especially start-ups. Although cloud computing is considered as the service mode of the next generation Internet, and cloud computing services have become more and more perfect after this year's rapid development and research, data security and privacy protection are still the main challenges restricting the further development of cloud computing. Different from the traditional computing mode in which users completely control data computing and storage locally, cloud computing requires that users' data and physical servers be managed in the same cloud service provider,

and users only retain some control permissions on the leased virtual machines.

2.1.2 Blockchain

Blockchain is an open decentralized distributed database, which is formed by orderly linking many data blocks generated by cryptographic algorithms according to the generation time. In recent years, with the popularity of digital currency, blockchain has become more and more familiar to people. Blockchain related technologies and mechanisms have become a new research hotspot in academia and industry. Blockchain is a new distributed computing paradigm. Its core design idea and advantage is decentralization. By means of encryption algorithm, timestamp technology, consensus mechanism and incentive mechanism, network technology can be used in distributed systems where nodes do not need mutual trust to achieve point-to-point information transmission, coordination and cooperation based on decentralization.

Blockchain is composed of a series of block sequences arranged in chronological order. It saves a complete list of all effective transaction records in the network. Each data block in the blockchain generally contains two parts: block header and block body. In the block, the block body mainly contains a transaction counter and detailed transaction data. The block header contains Merkle root hash, parent hash value, timestamp, calculation difficulty, random number and other information. The maximum number of transactions a block can contain depends on the size of each transaction and the block size. The types of data records are determined by scenarios, such as asset transaction records, asset issuance records, liquidation records, and Internet of things data records. Data records are usually organized into a tree logical structure in the stored procedure, such as Merkle tree. The underlying data is evaluated layer by layer through hash functions such as SHA-256 until the hash value of the Merkle root node is finally obtained, which is the root hash of the current block. Other information of timestamp also includes the version information of the block, random number, etc. random number is an important parameter in the workload proof mechanism.

2.2 Characteristics of Art Transaction

2.2.1 Difficult to evaluate

Although there are general criteria for judging works of art, it is difficult to accurately judge their academic value and historical value, because they lack a specific quantitative scale. Moreover, it is unrealistic to judge the price of artwork according to its artistic value.

2.2.2 It is difficult to distinguish true from false

A typical feature of artworks is that there is often serious information asymmetry in the transaction, which makes it difficult to distinguish the true from the false. The reason is that artworks are the cognition of things expressed by artists according to their own accomplishments and techniques, with the help of a certain way of expression in a certain era and a certain carrier. To have an accurate understanding of these carriers, that is, works of art, we must have the ability to distinguish between two sides: first, we must have a deep understanding of the creative background and knowledge symbols of the historical era; second, we must have a clear understanding of the creator, that is, the artist's own creative environment, personal style, and even creative ideas. However, it is difficult for later collectors to have an accurate understanding of the above information, which brings the problem of asymmetric information in art collection, and then brings the problem of difficult identification of true and false art.

2.2.3 Transaction cost Bureau

In order to reduce the risk of buyers, the real art transaction generally has to go through the process of identification and evaluation, and to ask the authority to identify and evaluate, which itself needs to pay a lot of expenses. At the same time, most works of art are easy to be damaged and have high requirements for storage. They often need special places and commercial insurance, which increases the transaction cost. Works of art are often traded through auction, which brings the commission expenses of auction and so on. Therefore, the decision-making cost of art transaction is high.

2.3 Application Design and Implementation of Blockchain Artwork Trading Platform

2.3.1 Design of blockchain Art Trading Web Platform

The process of embodying the blockchain behavior is the step of transaction completion. The registration and payment are in the application layer. The condition of transaction generation is that one user registers the order and another user initiates the payment. To complete the transaction, the operation needs to be carried out on the blockchain. The smart contract will call the digital contract of the transaction and the intelligent scheduling mode of the authentication scheduling side, so as to determine whether to execute the transaction. Execute transaction, that is, write the block to return the successful transaction, and inform the scheduling module of the authority to execute the scheduling, and also have the authority to veto the transaction and not write the block.

According to this mode, the transaction sequence of the blockchain trading platform is designed. It can be seen that compared with the traditional centralized trading platform, the blockchain service module provides energy side trading services. The blockchain service module can use hyperledger or other blockchain modules, making the platform easy to use. The user can register or pay the bill. When registering the bill, the user is the power seller; when paying, the user is the power buyer. That is, users can be both producers and consumers. This mode of combination of production and marketing conforms to the definition of Internet.

2.3.2 RPC model based on nodesdk

Use the super ledger development tool (SDK), including Java, nodejs, Python and other high-level language support. Among them, the SDK using nodejs language has the most perfect function. Nodejs is a JavaScript running environment based on chrome V8 engine of Google browser. Nodejs is characterized by non blocking and event driven, which is suitable for high concurrency environment. Nodejs mainly interacts with smart contract through stub, and sends parameters that need to operate on smart contract to smart contract through stub in the form of request in the contract.

2.3.3 Algorithm mechanism

Quorum is composed of a set of system nodes, and the intersection of any two quorum is not empty. Suppose the system node set is S , $S = \{Q_1, Q_2, \dots, Q_n\}$, $Q_i \cap Q_j \neq \emptyset$, and $Q_i \cap Q_j \subseteq S$, which satisfies formula 3-1, then S is called a quorum.

$$\forall Q_i, Q_j \in S \quad (1)$$

$$Q_i \cap Q_j \neq \emptyset \quad (2)$$

Quorum has the following properties: any two quorum have at least one common and correct node, and there must be a quorum without error. In this paper, $2/n$ node is defined as a quorum, which can ensure that at least $2/n$ node in a quorum has no error, and n is the maximum number of error nodes in the system.

Each view is numbered as v . In a view with a total of n nodes, there is a master node whose number is v . The rest of the nodes are backup nodes, which are called replica. Each node is represented by an integer, which is 0, 1, ..., $n-1$, satisfied

$$p = v \bmod n \quad (3)$$

Where / span > is the number of the view. When the primary node in the group fails, the next numbered node becomes the primary node.

3 EXPERIMENTAL ON THE APPLICATION OF BLOCKCHAIN TECHNOLOGY IN ART TRADE

3.1 Test Process

In order to simulate the real art block chain transaction mode, a micro grid sand table system is built based on the block chain electric energy transaction platform to simulate the block chain transaction mode. The data nodes in the chart simulate the execution scheduling after the transaction is completed. The node line will be connected by the mode port of color direct connection, and the simulation platform executes the scheduling entity of intelligent contract. The whole platform is located in the same gateway and belongs to the same channel on the blockchain side. Transactions need consensus among nodes. Nodes are deployed in raspberry as isolated nodes between docker containers. The web interface is used as the display terminal of node information and is responsible for displaying the transaction logs of each node.

3.2 Model Establishment

Firstly, this paper selects the appropriate blockchain architecture, deploys the blockchain application, analyzes the transaction process of member management, identity authentication, consensus mechanism, consensus process, contract call, configures the node, channel and other blockchain modules in the virtual container, and realizes the P2P blockchain transaction in the virtual container by using the smart contract.

3.3 Composition of Test System

According to the designed blockchain trading platform system, this paper designs a blockchain artwork trading platform based on B / S architecture and hyperledger blockchain architecture. From the system architecture diagram, it can be seen that the system is divided into five software systems: simulation center software, virtual artwork software; front-end web system of trading system; back-end system based on flash; hyperledger block system.

4 EXPERIMENTAL ON THE APPLICATION OF BLOCKCHAIN TECHNOLOGY IN ART TRADE

4.1 Investigation and Research on China's Art Transaction Volume

In recent years, fundamental changes have taken place in China's art market. China's art market has also begun to shift from a scattered collection market to a regulatory and regulatory investment market. Through consulting relevant research and domestic and foreign surveys, the following table is the data based on the data.

Table 1. China's art trade volume and growth

particular year	Trade volume of artworks	Art trade growth
2005	647	149
2006	770	146
2007	932	196
2008	1072	161

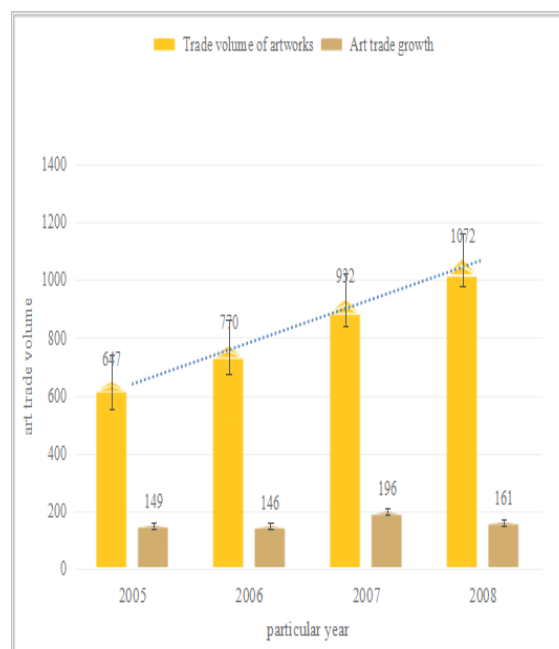


Figure 1. Trend chart of China's art trade volume

The results are shown in Figure 1. The overall growth of China's art market is rapid, but it is also affected by economic fluctuations and other factors. According to the data of the art market monitoring center, China's art market has maintained a growth rate of more than 20% from 2005 to 2007. However, affected by the 2008 financial crisis, China's art transaction volume, regardless of the number of transactions, the unit price of art transactions, or the total amount of transactions, have decreased significantly. The deterioration of the economic

environment should be considered as the most important factor contributing to this phenomenon.

4.2 Mechanism Test

In this paper, nodesk is used to encapsulate RPC remote call model of smart contract, data index and CouchDB API are used to query and proofread block information, web interface is used to build Vue + Flash + uwsgi + nginx mode, and simulation sand table platform is built to test the two combination methods.

Table 2. System test data of blockchain trading platform

Transaction information	Transaction amount	Transaction execution time
B transfers to a once	60	18
A transfers to B once	35	16
B transfers to A twice	100	18
A transfers to B twice	100	18

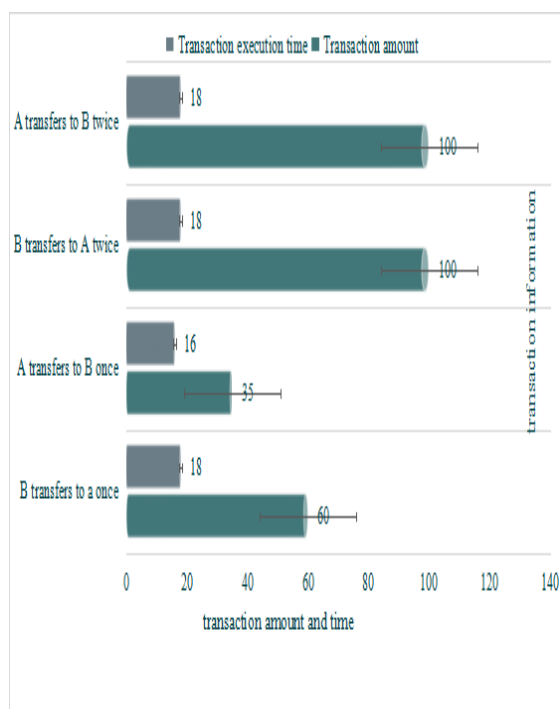


Figure 2. System test data of blockchain trading platform

The experimental results are shown in Figure 2. Figure 2 shows the physical model and related test data of the blockchain art trading platform under the system model. The transaction execution time is mainly spent in the authentication consensus phase of each node. The

average transaction time is about in 17 seconds, the accuracy standard of the transaction is block writing and simulation scheduling in the system model. The results of the test are in line with expectations.

5 CONCLUSION

As the most popular distributed application of the Internet, blockchain technology has many similarities with art Internet transaction. Many scholars have also proposed the concept of art transaction blockchain. With the development of bitcoin and Ethereum, blockchain technology has been widely recognized by the public. However, the biggest bottleneck of blockchain technology is the application scenario. This paper first analyzes the situation of art transaction in China, and then uses the system module to implement a complete blockchain art transaction, simulates the decentralized art transaction behavior in four nodes, and verifies the feasibility of the transaction platform and art blockchain transaction. Finally, a blockchain sand table system is built on the basis of this system.

REFERENCES

- [1] Ariwibowo G A. Book Review: Art, Trade, and Cultural Mediation in Asia [J]. Journal of Historical and Cultural Research Journal, 2020, 12 (1): 119-120.
- [2] Bialynicka-Birula, Joanna. MODELLING INTERNATIONAL TRADE IN ART - MODIFIED GRAVITY APPROACH[J]. Procedia Economics & Finance, 2015, 30(1):91-99.
- [3] Huang Qiubo, an Qingwen, Su houqin. Research and implementation of an improved pbft algorithm as Ethereum consensus mechanism% study and validation of an improved pbft algorithm as an Ethereum consensus mechanism [J]. Computer applications and software, 2017, 034 (010): 288-293.
- [4] Huang K , Tang Y . Disputes over Forgeries in EU Art Trade and Implications for China [J]. The Journal of International Relations, 2019, 22(2): 165-183.
- [5] Launer J . Medicine and the art of trade-offs [J]. Postgraduate Medical Journal, 2020, 96(1139):575-576.
- [6] Miraz M H , Ali M . Applications of Blockchain Technology beyond Cryptocurrency[J]. Annals of Emerging Technologies in Computing, 2018, 2(1):1-6.
- [7] Sun J , Yan J , Zhang K Z K . Blockchain-based sharing services: What blockchain technology can

- contribute to smart cities[J]. *Financial Innovation*, 2016, 2(1):1-9..
- [8] Sikorski J J , Haughton J , Kraft M . Blockchain technology in the chemical industry: Machine-to-machine electricity market[J]. *Applied Energy*, 2017, 195(JUN.1):234-246.
- [9] Yeoh, Peter. Regulatory issues in blockchain technology [J]. *Journal of Financial Regulation & Compliance*, 2017, 25(2):196-208.
- [10] Zhu Liehuang, Gao Feng, Shen Meng, et al. Survey on privacy preserving technologies for blockchain technology [J]. *Computer research and development*, 2017, 054 (010): 2170-2186.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

