ISSN: 2664-9640

Blockchain technology and application field based on literature analysis

Haizhu Liu*, Lingyue Yang, Wenyi Li

Anhui University of Finance and Economics, China

* Corresponding Author

Abstract

Blockchain technology uses the distributed node consensus algorithm to generate and update data, which has the excellent characteristics of decentralization, non tampering, uniqueness of value representation and so on. Today, blockchain technology has expanded its application in many fields and opened all kinds of blockchain project scenarios. This paper introduces the concepts and infrastructure related to blockchain, and focuses on the development status of its application technology and new application scenarios.

Keywords

Blockchain technology, Blockchain application, Intelligent contract, Literature analysis.

1. Introduction

Originally, Satoshi Nakamoto designed and released *P2P* (peer-to-peer transmission) network and the open source software built on it in 2008, and proposed the concept of BitCoin, which exists in a peer-to-peer form: this form of transmission implies the decentralized nature of the payment system. For Bitcoin, its core technology is blockchain technology, which includes many traditional information technologies, such as smart contracts with high security, unified and standardized consensus mechanism, and distributed data storage. Compared with traditional technology component network systems, blockchain has three core characteristics: high security, decentralization, and data traceability. Based on these three characteristics, the process of using blockchain to record information has more authenticity and integrity.

2. Introduction to blockchain related concepts

2.1. Blockchain characteristics

2.1.1. Decentralized self-organization

In essence, blockchain is a decentralized distributed ledger. The process is to generate and store data in blocks. The final chain structure is connected according to time series and formed end to end. [1] Blockchain does not rely on intermediaries to exchange information in the process of operation, but uses pure mathematical methods to form smart contracts to ensure the trust of distributed systems.

2.1.2. Imtamability

The unique ledger form that blockchains build from hashes results in their immutable nature. This is mainly related to the characteristics of hash operation and the construction characteristics of block chain.

First of all, hash operation itself has the characteristics of forward fast, reverse difficult, strong collision. Hashes can quickly output a hash after a given input and can greatly magnify small changes in input information, making it difficult to infer changes in data by comparing old and

new hashes. It is difficult to reverse hash operation, which ensures the security of hash algorithm to a certain extent.

The chain structure of the block chain makes good use of the characteristics of the hash algorithm. After the operation of the hash algorithm, the data of each block will obtain the unique hash value that can represent the block. The previous hash value is embedded in the header of the next block data table, thus connecting all blocks in series to form a blockchain. The tight union between blocks causes tampering with one block to be equivalent to tampering with the data of all subsequent blocks, which is extremely costly and means that tampering is virtually impossible.

2.1.3. Value uniqueness

Ethereum's token standards include ERC20, ERC721, ERC223, ERC621, ERC827, RFC, and EIP, demonstrating the unique characteristics of blockchain value. In the blockchain world, centralized bookkeeping keeps the value of bitcoin unique by recording it.

2.2. Type of blockchain

According to the scope of the network and the nature of the participating nodes, blockchain can be divided into public chain, alliance chain and private chain [2], whose characteristics are shown in Table 1.

Table 1: Different types of blockchain characteristics

	The chain of public	League chain	The chain of private
Participants	Free in or go	Union member	Individual or company
Consensus mechanism	Pow/PoS/DpoS, etc	Distributed consistency algorithm	Distributed consistency algorithm
Accounter	All participants	Consultation of alliance members	The custom
Incentive mechanism	Need	Optional	Optional
Degree of centralization	Decentralized	(Multi) centralization	(Multi) centralization
Outstanding features	Establishment of credit	Efficiency and cost optimization	Transparency and traceability
Bearing capacity	3 ~ 20 per second	1000-10000 / SEC	1000-200000 / SEC
Typical scenario	Cryptocurrency, forensics	Payment, liquidation, public welfare	Provincial level, distribution

2.3. Blockchain infrastructure

With the increase of blockchain application scenarios, the architecture of blockchain has also changed accordingly. However, the architectures of different blockchain platforms still have some commonalities. Typically, blockchain infrastructure is broken down into six layers, consisting of an application layer, a contract layer, an incentive layer, a consensus layer, a network layer, and a data layer. [3] The data layer connects different data blocks and generates chains through pointerlike timestamp and cryptography asymmetric encryption algorithm methods. As the basis of blockchain technology, the data layer realizes the storage of relevant data and the protection of transaction security. The operation process of the network layer is

ISSN: 2664-9640

to use a *P2P network* to disperse resources from the network through all nodes, so as to provide services for information transmission between nodes and realize information exchange and data flow of each node. This method avoids the tampering risk of the centralized server and achieves decentralization. Nodes inform other nodes of the generation of new blocks through the broadcast mechanism, and verify the newly created blocks with the help of the verification mechanism, and jointly maintain an underlying ledger. Consensus layer through the unified mechanism algorithm, so that the scattered nodes reach a consensus, decide the bookkeeper. The incentive layer considers adding economic factors for blockchain participants, creating economic incentives and penalties for the system, and effectively promoting the benign development of the whole system. The contract layer is the foundation of blockchain's programmability, allowing anyone to participate in the blockchain and ensure that their programs run efficiently. The application layer is the display layer of the application of blockchain technology to the actual background and situation, and the deployment of various applications built on specific cases.

Each layer of blockchain has its main task. On the basis of this task, each layer can cooperate with each other and achieve a centralized mechanism, see Figure 1.

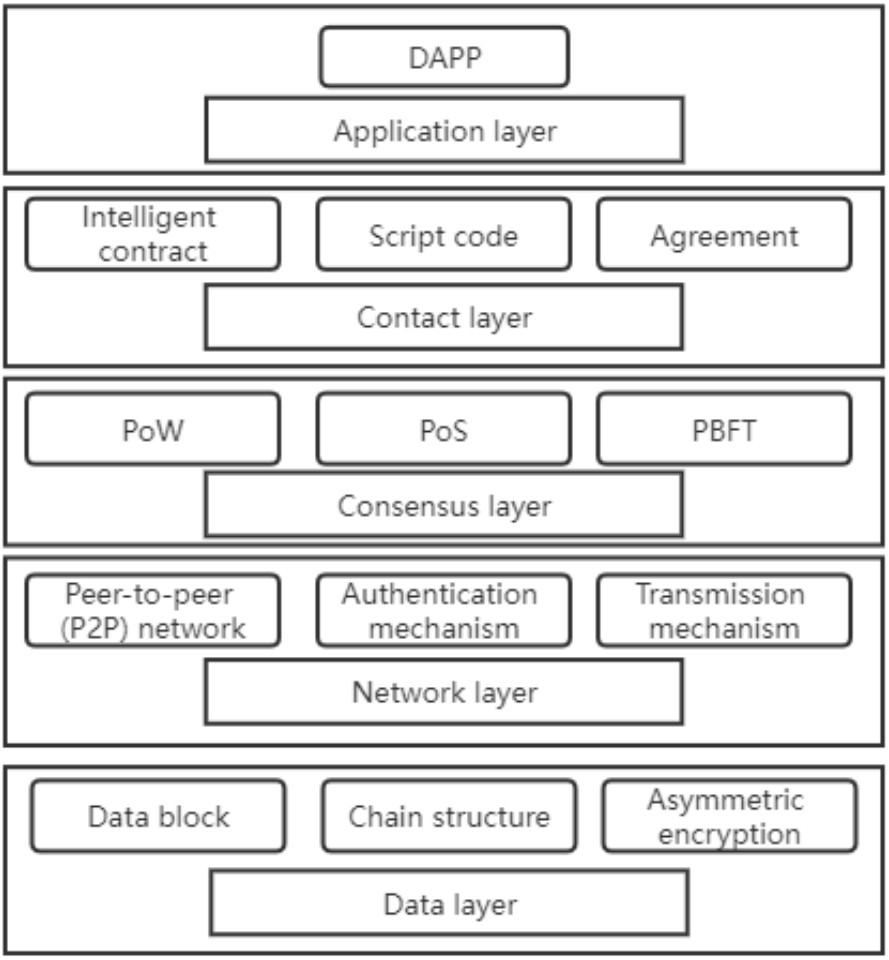

Figure 1: Blockchain common architecture model

3. The key technology of blockchain

3.1. Consensus mechanism

Consensus mechanism is one of the key contents of blockchain, because in blockchain, each node is highly dispersed, forming a distributed system, and it is relatively difficult for these

dispersed nodes to reach consensus. At present, there are many kinds of proof of consensus mechanism, such as proof of work (POW), proof of stake (POS), etc. [4]. These consensus algorithms prevent the bifurcation of blockchain and ensure the consistency of ledger data. Consensus mechanisms are classified into various categories, but the specific commonality is to select suitable data writers by designing a fair election mechanism, and to secure new data by designing a reliable verification mechanism.

3.2. Intelligent contract

A computer intelligent contract is a digitally defined commitment to verify and enforce a contract in an information-based manner. It is generally implemented as follows: reach an agreement - >Contract enforcement - > Computer-readable code that enables traceability and authenticity of transactions between parties without third-party guarantees. At present, there are many types of smart contracts, and the most important factor affecting the choice of contract types is the nature of the assets to be traded during the performance of the contract.

3.3. Merkle tree

Merkle tree is a binary tree, which is characterized by unfixed basic data and bottom-up layer by layer calculation. In a blockchain, a block consists of a block head and a block body. [5] The hash data and timestamp constitute the block header, and the current transaction tree constitutes the block body. As a binary tree, the Merkle tree in the block chain keeps its leaf nodes as even numbers. When the number of transactions occurring in the block is not even, the data is copied and reconstructed to form a balanced tree. At present, a classic application scenario of Merkle tree is P2P download. In the point-to-point network data transmission, the data is divided into several small pieces of transmission, so as to achieve the purpose of reducing the cost of re-downloading data error.

3.4. Asymmetric encryption

Classic symmetric encryption is the process of adding only one key. Asymmetric encryption, on the other hand, uses a public key and a private key with strict permissions. [6] In essence, asymmetric encryption uses mathematical algorithms to generate numerical values as keys, and encrypts and decrypts each other through public and private keys to complete the work of identifying the authenticity of signatures. Asymmetric encryption technology is applied in the process of blockchain information transmission and digital signature, and commonly used encryption algorithm technologies include RSA, ECC, ECDSA, etc. This asymmetric encryption greatly reduces the risk of third-party members stealing information during the simultaneous generation of private keys, improving the security of transactions in the blockchain.

4. The development and application of blockchain technology

Because the chain of blocks has said value and uniqueness, to center the self-organizing, tamper-resistant and information traceability etc, its application is also from the original single currency to multiple levels of monetary extension development, through its can try to establish and complete the transaction records to each value of the asset, so as to realize the decentralized management of target asset markets, Therefore, this technology has a certain development prospect in different industries. For the investigation of the application and development of blockchain technology, this paper starts from the overall and specific research literature respectively, and makes a preliminary analysis of the number of blockchain-related literature published, and then adopts the literature review method to summarize examples from different application scenarios.

ISSN: 2664-9640

4.1. Research literature analysis based on blockchain field

4.1.1. Literature source and processing

Specifically, this paper takes the cnKI general database platform as the object and selects CSSCI and CSCD databases as data sources, which include influential Chinese core academic journals in the fields of social sciences and natural sciences. To cover as much as possible research topics related to block chain technology and application, this paper selected topic = (" block chain application "OR" block chain technology "OR" block chain scenario ") as a retrieval strategy for retrieval, literature type selection "academic journal", actual content and retrieve relevant results rejected, by 2022, up 2569 paper, The literature was published in 2014 at the earliest.

4.1.2. Analysis of literature growth trend

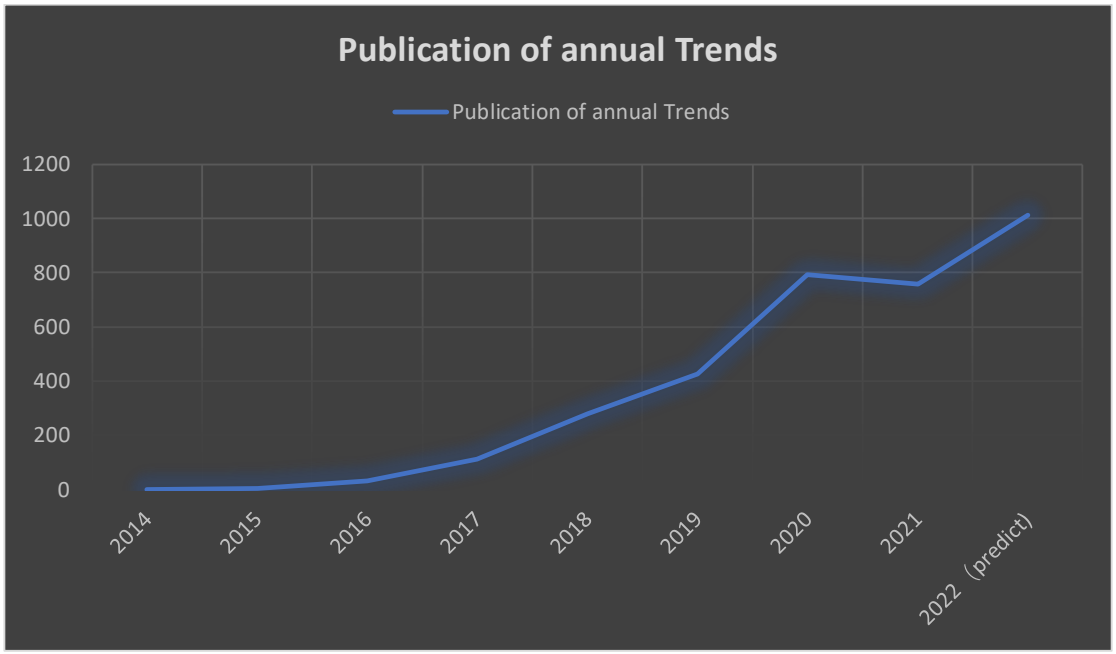

Figure 2: Trend of publications in blockchain research field from 2014 to 2022

The change in the number of documents reflects the change in researchers' interest in the blockchain field. According to the trend chart of annual paper publication, the overall research in the field of blockchain showed a gradual upward trend from 2014 to 2022, especially from 2017, which started an upward trend: Since January 2009 COINS network, block chain field vision gradually entered the industry at home and abroad, in the 2017, even if the block chain fruitful practical applications, however academia to block chain awareness is not high, but in 2015, block chain on the *economist's* cover after the development of blowout ushered in the industry. [7]

4.1.3. Analysis of subject distribution

From the perspective of discipline distribution statistics, the research field of blockchain presents a diversified development situation. As can be seen from Figure 3, computer software and computer application are the subjects that publish the most blockchain research papers, accounting for 40.37%, followed by finance, information economy and postal economy, accounting for 7.53% and 5.81% respectively. Existing research on blockchain focuses on computer software and applications and economic fields, which also covers interdisciplinary fields, artificial intelligence methods and applications, information systems, etc. Traditional financial assets can be integrated into the blockchain ledger to form digital assets of the blockchain, which can be traded on the blockchain. Therefore, remote payment, securities trading, digital notes and other financial research is also developing rapidly.

ISSN: 2664-9640

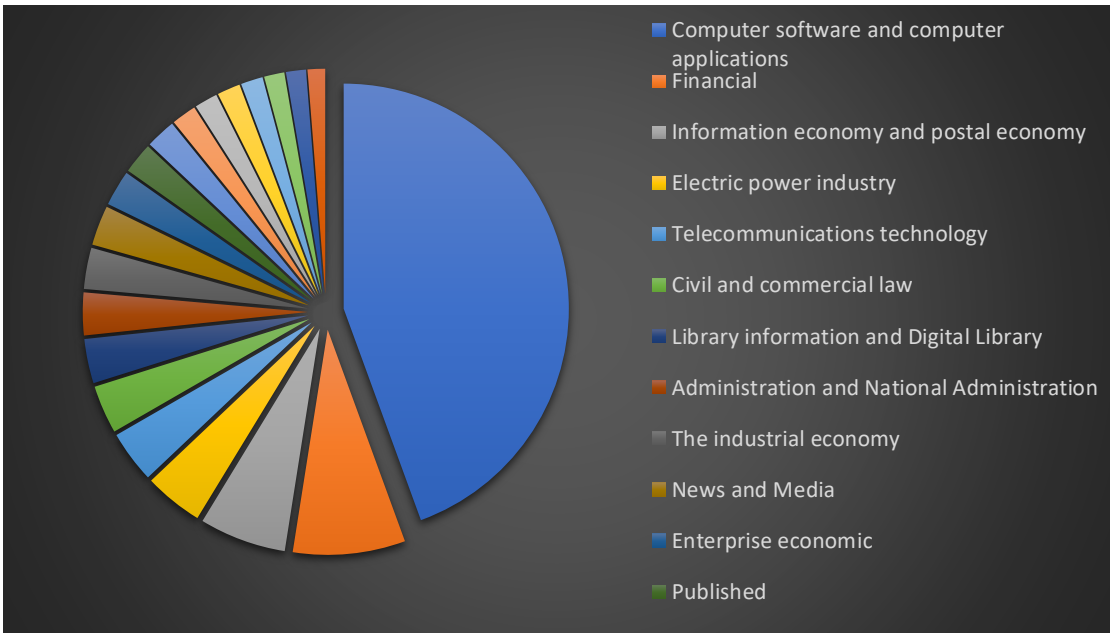

Figure 3: Proportion of blockchain research publications from 2014 to 2022

4.1.4. Analysis of the distribution of source journal

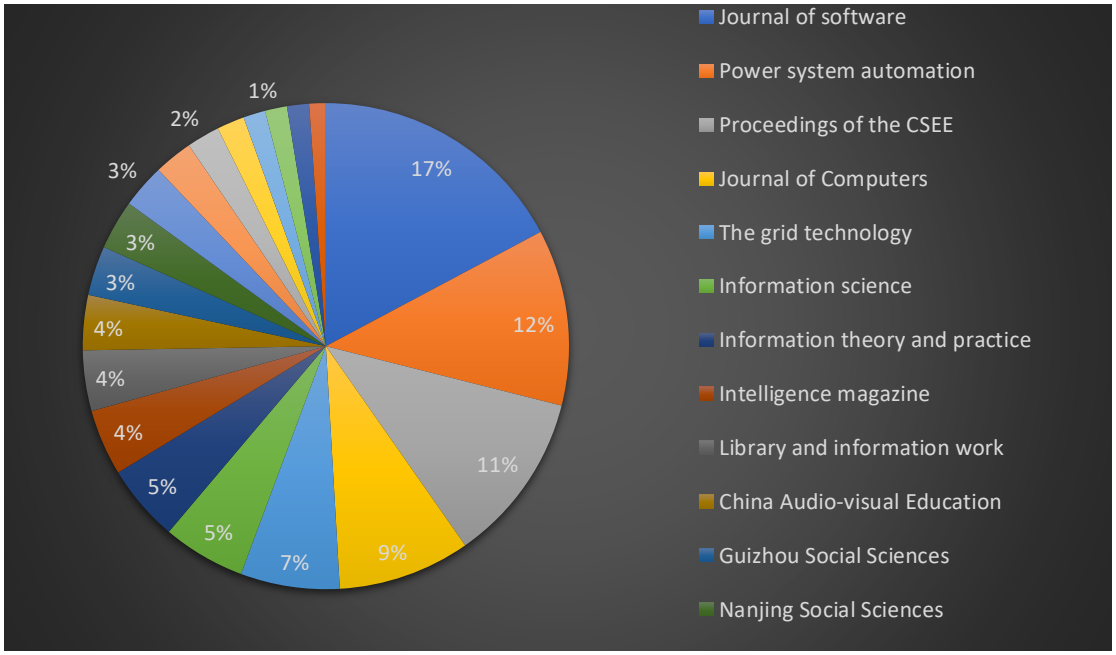

Figure 4: Distribution map of source journals of blockchain literatures published in 2014-

According to the distribution chart of periodicals published in Figure 4, the core periodicals published in block chain in China are mainly in the financial field, including technical innovation, small and medium-sized enterprise economy, commercial law, financial innovation, quality and operation management and other subdivision fields. In addition, the philosophical aspect of blockchain will also be of concern to the general public [8] regarding the reputational risks associated with the application of blockchain technology in a variety of new scenarios. The visualization shows that by April of 2022, the number of articles published has increased significantly, and it is expected that the number of articles published in the blockchain field will rise in 2022.

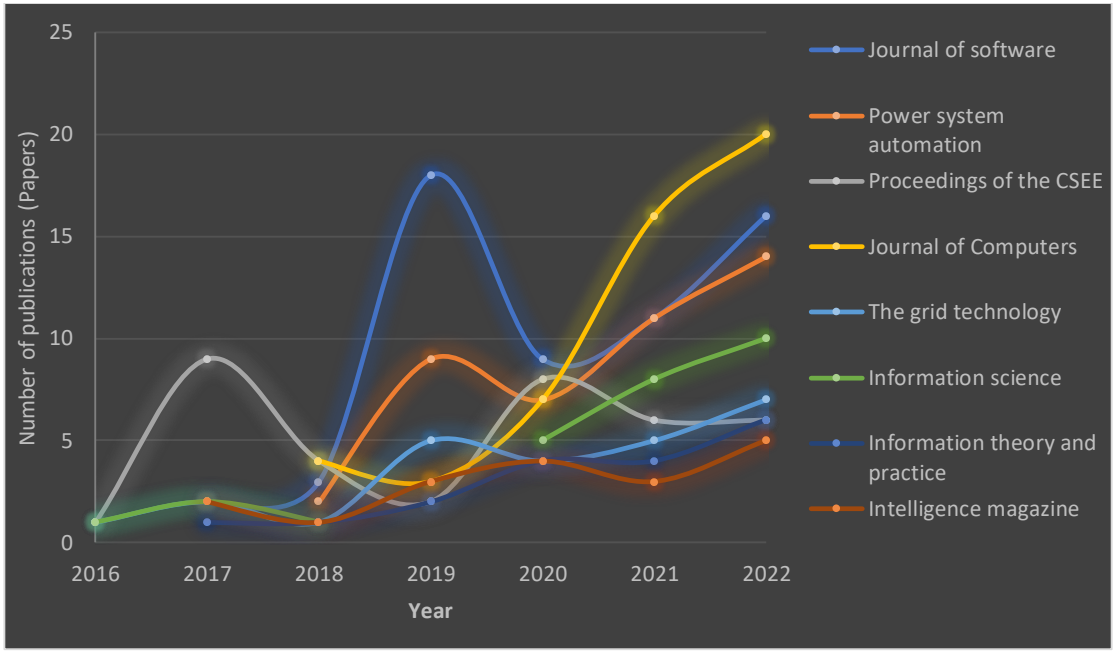

Figure 5: Trends of publications in the top eight journals by volume 2016-2022

4.1.5. Application development of blockchain technology

The financial sector has been involved in blockchain technology since its inception. Bitcoin, founded by Satoshi Nakamoto's *Genesis Blockchain*, is the poster child for the use of blockchain, [9], and sparked a global *mining craze* when it was launched. [10] The essence of the tocoin approach adopted by startups to fund their goals is that blockchain technology is booming and becoming more widely used at a time of intense regulation of virtual currencies and ICOs. At present, blockchain has been widely applied in five specific fields, including cryptocurrency, e-government, medical and health, supply chain management and Internet of Things construction.

4.2. Application development of blockchain technology

4.2.1. Cryptocurrencies

Coinbase, the largest cryptocurrency company to date, went public in April 2021. The series of *MEME* coins, represented by squid tokens, has set off a cycle of investment and speculation [11]; More and more researchers begin to study anonymous transactions through the analysis of cryptocurrency transaction networks to fight against cryptocurrency crimes or achieve de-anonymization. Zcash'(2014)[12] correspondingly enhances the security of virtual currency transactions with the zero-knowledge concise Anonymous Payment scheme (DAP scheme), which enables transactions to be smooth by hiding the source of payments. Bonneau (2015) [13], et al., provide a comprehensive introduction to the use of virtual cryptocurrencies and domain implementations. Bashir (2016) [14] emphasizes the use of bitcoin blockchain protocol, and adopts a regression method to predict the possible development of bitcoin ownership and express opinions and suggestions on it. With the gradual development of smart contract language made public, people also found the security risks contained in it. Therefore, some scholars proposed to add Seh signature into the background rules of smart contract to further improve privacy secrecy and imtamability.

4.2.2. The electronic government affairs

According to the 2019 China Internet Network Security Report released by the National Internet Emergency Response Center in August 2020, as many as 320 government websites in China were implanted with backdoors, accounting for 8.02%(320/4066) of the total.

To optimize privacy disclosure in the process of sharing government data, Shi Yuliang (2019) [15] et al., based on probability statistics and The Del entropy method, proposes a

comprehensive evaluation model to evaluate the level of a privacy maintenance system based on lump-confused privacy protection techniques. Chen Zhanfang (2013) [16] et al designed an interactive access control information security platform by using role-based Access Control (RBAC) and other blockchain technologies. In addition, jiang Huowen (2017) [17] et al. proposed a table data publishing algorithm based on greedy clustering anonymity from the perspective of the object type itself, and ensured that the algorithm could approach the optimal in terms of anonymous time and total information loss. Svein ø Lnes (2017) [18] proposed a variety of government applications of blockchain technology: digital identity, marital status registration, storage to aid justice, financing and tracking funds, criminal records, etc. Marcella Atzori (2017) [19] expands blockchain to include proof of identity, an effective tamper-proof tax system, and more.

4.2.3. Health care

The medical industry is a health care industry for people's livelihood. By 2019, the number of medical and health institutions in China has reached 1 million. At the same time, a large number of health institutions will inevitably produce a huge database related to health care, and the safe storage and sharing of patient information has become an important application of blockchain.

da Conceição (2018) [20] etal., based on blockchain technology, proposes a general architecture that includes wallet, blockchain, data service, and index service: for storing patient electronic health record data. Kushch (2019) [21] etal. (2019) store electronic medical data on blockchain, a system that stores patient medical data to form a distributed database. In terms of data sharing platforms, Jingwei Liu (2018) [22], etal. proposes a privacy-conscious data sharing solution for healthcare that automates secure data sharing and provides robust privacy protection for data sharing. Zhang Lihua (2019) [23] etal. proposed a double-chain structure scheme, *EMRSBC,* for secure storage and sharing of medical data, in which smart contracts are signed on blockchain to implement access control in a faithless environment. Feng Tao (2020) [24] etal., based on the Alliance blockchain, ranks healthcare institutions based on their resource distribution and proposes a healthcare data security model that uses a hybrid consensus mechanism called *DPoS+PBFT* to share healthcare data. In 2017, AliHealth [25] launched its first blockchain pilot project, Medical *Alliance + Blockchain*, to address *information silos* and data security issues in a cost-effective, high-security way to communicate information.

4.2.4. Supply chain management

In industry supply chain, the enterprise to block chain for interface, object directly upload goods from production to circulation data, the centralized management mode into the distributed management mode, can effectively maintain the central industry supply chain management system caused by the high cost and low efficiency problem, with update iterative block chain technology, also bring the corresponding technology to supply chain field development.

Grest M (2019) [26] et al. proposed a metamomodel to realize supply chain traceability, and used blockchain technology to aggregate traceability management systems into a unified system, thus solving the problem of supply chain information flow slowdown caused by the use of different traceability systems. Kumar R (2019) [27], et al., proposes a framework for secure storage of goods supply chain data using blockchain and encrypted QR codes to prevent replay and man-in-the middle attacks and improve the security of product supply chain data storage. Zhu Jianming et al. [28] put forward the multi-center authentication model of supply chain, and introduced the block chain transaction structure suitable for the integration of business-to-business (B2B) and business-to-customer (B2C) supply chain electronic transactions. Ding Qingyang et al. [29] established a blockchain e-commerce product traceability and anti-counterfeiting model to address the issue of product anti-counterfeiting. In March 2018,

Tencent and China Iot signed a strategic cooperation agreement to launch the blockchain alliance and waybill platform. In June, JD launched the blockchain Anti-counterfeiting traceability open platform, which is free to brands within jd ecosystem [30]. In 2019, Huawei launched the blockchain service BCS on Huawei Cloud and described the application scenarios of blockchain technology in the field of supply chain.

4.2.5. Building the Internet of Things

Traditional centralized management of iot devices is prone to user privacy leaks, low processing efficiency, and the sheer number of devices, low computing power, and lack of a direct connection to the Internet. [31] Blockchain, as a distributed technology, can make up for the above shortcomings and meet the needs of Internet of Things construction.

Based on the temporal nature of iot data, Jang J et al. (2017) [32] proposes a data flow structure, which is aimed at the consolidation of data records and applies to scale-down systems. Barbierato et al. (2019) [33] proposes distributed data storage, the use of data stored on local networks, which can effectively reduce transmission costs. Cai H et al. (2017) [34] improved the data processing capability of the system in combination with cloud computing to solve the problem of insufficient computing power of traditional information systems. Nodes collect data and upload it to the cloud center for centralized processing. The problem of access login needs to be solved first through identity authentication and access control, and a mutually authenticated, lightweight identity protocol is currently available [35]. Zhang Zhiwei et al. (2020) [36] proposes research predictions for future blockchain data management, including business process optimization, data privacy protection, and smart contract-based information management optimization. Cheng Guanjie et al. (2020) [37] uses distributed storage to reduce the intensity of real-time node data synchronization; The access control system based on block chain is constructed and the plasticity of the system is improved by computing algorithm.

5. Conclusion

This paper introduces the basic concepts of blockchain, whose basic characteristics include decentralization, imtamability and uniqueness of value. As well as introduces the three types of blockchain, the blockchain infrastructure is divided into six layers, and then introduces the key technology of blockchain. After the overview, the author conducted data analysis and field summary of blockchain-related research literature. Taking *THE CNKI* database as an example, the author explained the research frontiers and hot trends, and introduced the current application fields: First, it is applied to cryptocurrency to enhance the security of bitcoin transactions. Second, it is applied in the field of e-government. The imtamability of blockchain optimizes the privacy disclosure of shared data in government data. Finally, the application of blockchain technology in the construction of the Internet of Things can make up for the existing shortcomings and problems of the traditional Internet of Things and meet the needs of the construction of the Internet of Things. As society develops, blockchain will be applied to more emerging technologies in other areas. Such as *5G, artificial intelligence* and *Wisdom cities.*

References

[1] S.Wang:Security development of blockchain,Democracy and Science,2018(04),p44-45.

[2] Q.F.Shao,C.Q.Jin,Z.Zhang,etal.:Chinese journal of computers,2018,41(05):p969-988.

[3] S.T.Guo,R.J.Wang,F.L.Zhang:A Review of the Principle and Application of Blockchain Technology. Computer Science, 201,48(02):p271-281.

[4] X.Han, Y.M.Liu:Research on consensus mechanism in blockchain technology. Information Network Security,2017(09):p147-152.

[5] M.Y.Wu,G.S.Zhu,S.C.Wu:Research on blockchain data Modification Method based on Merkle tree. Information Communication,2020(10):p10-12+16.

[6] G.C.Liu, Q.Li:Blockchain data privacy protection mechanism based on searchable encryption. Journal of computer applications,2019,39(S2):p140-146.

[7] R.X.Liang, Y.K.Li,Y.L.Wang, X.C.Zhang:Based on scientific knowledge map block chain research review. Journal of economic management, 2021 lancet (7) : p193-208. The DOI: 10.19616 / j.carol carroll nki. BMJ. 2021.07.012.

[8] H.Song,Y.D.Yang, Z.Tao:Block chain in the application of corporate finance: literature review and knowledge framework. Nankai management: 1-19 [2022-04-17]. http://kns.cnki.net/ kcms/detail /12.1288.F.20210907.1847.002.html

[9] C.C.Dai, H.J.Luan, X.Y.Yang, etal. :A review of blockchain Technology. Computer Science, 201,48 (S2):p500-508.

[10] OUYANG L W,WANG S,YUAN Y,etal:Design and design of a compact compact Architecture.Journal of Automation,2019,45(3):p445-457.

[11] C.H.Z.Wang, W.Cai. Yuan universe digital economy: the status quo, characteristics and development proposal. Big data: 1-13 [2022-04-17]. HTTP: / / http://kns.cnki.net/kcms /detail/ 10.1321. g2.20220401.1030.002.html

[12] Sasson E B,Chiesa A,Garman C,et al.Zerocash:Decentralized anonymous payments feom bitcoin//2014 IEEE Symposium on Security and Privacy.IEEE,2014:459-474

[13] Bonneau J,Miller A,Clark J,et al.Sok:Rearch perspectives and challenges for bitcoin and cryptocurrencies//2015 IEEE Symposium on Security and Privacy.IEEE,2015:p104-121

[14] Bashir,M.,Strickland,B.,Bohr,J:What motivates people to use bitcoin? In:Spiro,E.,Ahn,Y.-Y.(eds.)SocInfo 2016.LNCS,vol.10047,pp.347-367.Springer,Cham(2016).

[15] Y.l.Shi, W.Zhou, S.J.Zang, etal.:A Comprehensive Evaluation Model for Privacy Protection Based on Probability Statistics and Del Entropy Method. Chinese Journal of Computers, 2019, 42(04): p786-799

[16] Z.F.Chen, T.Y.Ma, H.W.Song, etal.:Design and Implementation of an Interactive Identity Authentication and Access Control Security Information Platform. Journal of Changchun University of Science and Technology: Natural Science Edition, 2013, 36(Z2):p157-160.

[17] H.W.Jiang, G.S.Zeng, H.Y.Ma:Journal of Software,2017, 28(02):p341-351. (in Chinese)

[18] Svein ø Lnesa Jolien Ubachtb, Marijn JanssenB. Blockchain in Government: Benefifits and implications of distributed ledgertechnology for information sharing. Government Information Quarterly 34 (2017) 355-364

[19] Atzori, M. (2017). Blockchain Technology and Decentralized Governance: is the State Still Necessary Journal of Governanceand Regulation, 6(1), 45-62

[20] DA CONCEICAO A F, DA SILVA F S C ROCHA V.E letronic Health Records using Blockchain Technology [J/OL]. 2018.. http://arxiv.org/abs/1804.10078.

[21] KUSHCH S, RANISE S, SCIARRETTA g. Blockchain Tree for eH ealth [J/OL]. 2019.. http://arxiv.org/abs/1908.04613.

[22] LIU J,LI X,YE L. BPDS: A Blockchain Based Privacy-Preserving Data Sharing for Electronic Medical Records.2018 IEEE Global Communications Conference, GLOBECOM 2018 - Proceedings, 2018.

[23] L.H.Zhang, F.Lan, P.P.Jiang, etal: Secure storage and sharing of medical records based on double block chain. Computer engineering and science, 2019,297(09):p61-67.

[24] T.Feng, Y.Jiao, J.L.Fang,Y.Tian.: Secure storage and sharing of medical records based on double block chain ,Computer science, 2020,47(04):p305-311. (in Chinese)

[25] Tower, a think-tank, chain block chain + medical study [EB/OL]. HTTP: / / https://max. book118.com/html/2019/0416/6232204050002023.shtml.

[26] Grest M, Lauras M, Montarnal A, etal:A Meta Model for a Blockchain-based Supply Chain Traceability. 2019 International Conference on Industrial Engineering and Systems Management(IESM).IEEE, 2019:p1-6.

[27] Kumar R,Tripathi R:Traceability of counterfeit medicine supply chain through Blockchain.2019 11th International Conference on Communication Systems & Networks (COMSNETS). IEEE, 2019:p568-570.

[28] J.M.Zhu, Y.G.Fu: Dynamic multi-center collaborative authentication model of Supply Chain based on Blockchain. Journal of network and information security, 2016,2(1) : p27-33.

[29] Q.Y.Ding, J.M.Zhu: Product information traceability and anti-counterfeiting model of B2C E-commerce platform from the perspective of blockchain. China circulation economy, 2017,31(12):p43-51.

[30] B.Yuan: Construction of international Logistics supply chain Management mode from the perspective of cross-border E-commerce. Business Economics Research, 2016(18):p103-105.

[31] Zhu X, Badr Y:Identity management systems for the internet of things: a survey towards blockchain solutions. Sensors, 2018, 18(12):p4215.

[32] Jang J, Jung I, Park J:An effective handling of secure data stream in IoT. Applied Soft Computing, 2017:p811-820.

[33] Barbierato L, Estebsari A, Pons E, etal: A Distributed IoT Infrastructure to Test and Deploy Real-Time Demand Response in Smart Grids. IEEE Internet of Things Journal, 2019, 6(1):p1136-1146.

[34] Cai H, Xu B, Jiang L, etal:IoT-Based Big Data Storage Systems in Cloud Computing: Perspectives and Challenges. IEEE Internet of Things Journal, 2017, 4(1):p75-87.

[35] Aman M, Javaid U, Sikdar B.:A Privacy-Preserving and Scalable Authentication Protocol for the Internet of Vehicles[J]. IEEE Internet of Things Journal, 2020, 8(2): p1123-1139.

[36] Z.W.Zhang G.R.Wang,J.L.Xu:Review of Blockchain data Management Technology. Journal of Software,2020, 31 (09): p2903-2925.

[37] G.J.Cheng, Z.J.Huang ,S.G.Deng: Journal of The Internet of Things, 2020, 4(02):p1-9.