ISSN: 2664-9640

Research on rural medical service system based on blockchain

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Abstract

As the most cutting-edge information technology in the current Internet field, blockchain can effectively alleviate today's rural medical dilemma with its excellent advantages of decentralized technology, promote a more reasonable and full use of social resources, improve resource utilization, and effectively improve the work efficiency of hospitals, and promote the wide application and development of blockchain + medical processes in rural areas. At the same time, because of its high stability and transparency and super traceability, it can ensure the complete storage and information security of rural medical data to the greatest extent.

Keywords

Blockchain, rural medical, decentralized technology.

1. Introduction

In recent years, with the state's encouragement of medical technology standardization, the integration and application of blockchain, big data, 5G and other technologies in the medical service system has become a huge driving force for rural revitalization. According to a report by Huawei, the application of blockchain changes over time, from the financial field in 2016, to intelligent manufacturing and the Internet of Vehicles in 2019, and after 2022, the most developed field is the medical industry. However, with the progress of society, the quality of people's medical quality in hospitals is getting higher and higher, which makes the medical level contradict people's needs, so it has become very important to establish a medical service system with blockchain technology as the core.

This paper aims to study the possibility of application in the field of rural medical services, and solve the problems of information asymmetry, fragmentation, backwardness and immaturity of existing medical models brought about by traditional medical management. Realize the upgrading of medical information management from traditional methods to intelligence and security, and then realize the purpose of rural revitalization, and provide targeted opinions for the state on the construction of rural medical system from the perspective of service system.

2. Body

2.1. Research significance and current status of research at home and abroad

2.1.1. Research significance

(1) Medical data sharing, efficient patient treatment: The introduction of blockchain technology, its decentralized characteristics can not only realize data sharing, but also indicate that the application of blockchain medical platform enables hospitals to establish a bridge for medical data sharing. While protecting patient privacy, it can also quickly understand the patient's condition, medication status and other information, which provides convenience for doctors and relevant experts and makes patients more efficient when visiting other hospitals.

ISSN: 2664-9640

(1) Greatly improve the level of rural medical care: The advantages of blockchain in medical care include reducing privacy leakage, increasing the reliability of data, realizing data traceability, patient-oriented medical service system, and realizing the value of medical data. The decentralization, openness and transparency, immutability, anonymity and privacy of blockchain can alleviate some problems faced by the medical industry, especially in the face of more complex problems in the rural medical industry, blockchain may realize the revitalization of rural medical care from traditional to modern to intelligent.

(3) Ensure the traceability and safety of drugs: The data traceability and openness and transparency of blockchain enable medical institutions to realize the on-chain of drugs in the production process of drugs, thereby ensuring that drugs can be traced throughout the production process. In this way, patients can know the exact source of drugs in time, so as to choose safer and more effective drugs to protect their health and safety.

(4) More convenient response to public health events: Medical institutions can manage and view information such as medical equipment and drugs in real time through the blockchain platform. The platform can reasonably allocate corresponding resources and effectively prevent and control certain public health events through some identification means. By going on the chain, medical supplies can also be traceable and transparent, ensuring efficient and reasonable use of materials.

(5) More convenient management of patient files: With the non-modifiable feature of data in the blockchain, patients can view their own medical diagnosis data very conveniently by viewing their own health records on the blockchain medical platform, so that when patients seek medical treatment next time, doctors can quickly diagnose and treat patients by viewing their historical medical data. For the analysis and summary of diagnostic data, blockchain can also provide patients with scientific and healthy management methods from diet, exercise and sleep.

2.1.2. Current status of foreign research

In 2019, Cornelius C. Agbo et al. showed that blockchain has many healthcare use cases, including electronic medical records, health data analysis, drug supply, and remote patient monitoring. Many of these blockchain-based healthcare services have been used as prototypes for emerging blockchain-based technologies, such as smart contracts, off-chain storage, and permissioned blockchains. However, they still need to do more research to address the scalability, latency, interoperability, security, and privacy challenges associated with the use of blockchain technology in healthcare to better understand and evaluate the role of blockchain technology in healthcare services[1].

In 2022, Aitizaz Ali et al. implemented a new homomorphic encryption method in medical systems using blockchain and deep learning techniques. This approach supports tamper-proof, immutable, and secure data to increase the reliability of healthcare data, and blockchain technology also supports distributed data, redundancy, and fault tolerance in digital systems, so users can securely search for the health-related data they need. In addition, the proposed method, applied to healthcare and blockchain technology, greatly improves security and anonymity compared to models such as Medrec, Medchain and Medbichain, and can also enhance the proposed model by applying different deep learning techniques[2].

In 2023, Luis B. Elvas of the University of Lisbon et al. showed how decentralization can be leveraged in the healthcare ecosystem to process large amounts of data and streamline complex medical processes. The solution they propose is to leverage blockchain technology to build an iterable, secure, scalable, accessible, and decentralized healthcare system that will enable patients to quickly and securely share medical information with doctors and hospitals while maintaining full control over the privacy of their medical data. This will address data

ISSN: 2664-9640

inconsistencies, lack of data security, unjustifiably high administrative overheads, and patient privacy issues in the current healthcare system[3].

2.1.3. Current status of domestic research

2017, researchers from Beijing University of Posts and Telecommunications found that medical data centers are basically built in large medical institutions based on the background of the medical industry. However, some smaller medical institutions have not implemented relevant policies, the population is relatively small, and the construction of data centers is not perfect, resulting in incomplete medical data and no strong data processing capabilities. Therefore, they designed a MIFS and AFS server group and used the improved DPOS consensus mechanism, which can effectively use the current status quo of medical institutions to achieve decentralized, secure, fast and traceable medical data sharing[4].

In 2019, Zhou Lijing of Beijing University of Posts and Telecommunications studied blockchain data privacy and solved the problem that it is difficult to support homomorphic computing and leakage privacy in blockchain applications. He combined the NVHSS algorithm, the NVFHSS algorithm, and the working principle of blockchain to propose the decentralized outsourcing computer system (DOC). In this mechanism, not only data privacy is protected, but the mechanism can also greatly reduce the storage space and authentication burden of users and server nodes[5].

In 2020, Hu Qinghan of Xi'an Jiaotong University and others put forward reasonable and effective suggestions for the information management of targeted donations of new crown pneumonia medical supplies, and they proposed a cloud platform model that requires very large node computers, a network running on the blockchain, and software resources owned by computers at different nodes, which provides a solid foundation for the realization of the blockchain system for the supply of epidemic prevention medical supplies[6].

In 2023, Ding Yangjun et al. applied blockchain technology to the electronic medical record system according to the security performance requirements of the electronic medical record system, combined with the advantages of blockchain technology such as tamper-proof, anonymity and security, and proposed a Byzantine fault-tolerant consensus mechanism based on machine learning in view of the lack of dynamism and low consensus efficiency of the PBFT consensus algorithm. Compared with traditional electronic medical records, blockchain electronic medical records based on improved Byzantine fault-tolerant algorithms make medical data more secure, and also greatly facilitate patients to see doctors across hospitals[7].

2.2. Research objectives and main content

2.2.1. Research objectives

This paper aims to study the possibility of blockchain application in rural medical field, and solve the problems of information asymmetry, fragmentation, backwardness and immaturity of existing medical models brought by traditional medical management. Realize the upgrading of medical information management from traditional methods to intelligence and security, realize the purpose of rural revitalization, and provide targeted opinions for the state on the construction of rural medical system from the perspective of service system.

2.2.2. Main content

(1) Overall analysis of rural medical service system based on blockchain

With the breakthrough innovation of blockchain application technology and artificial intelligence algorithm, this paper explores the possibility of application of blockchain technology in the field of rural medical care, solves the problems of asymmetry and fragmentation caused by the traditional centralized management of medical information, as well as the backward mechanism and immature technology of the existing medical model,

ISSN: 2664-9640

realizes the upgrading of medical information management from traditional to intelligent and secure, and realizes the revitalization of rural medical services.

(2) Suggestions for promoting the construction of rural medical service system based on blockchain

Finally, according to the survey results of the social practice of team members, corresponding optimization suggestions are put forward. For example, further promote the use of blockchain technology, promote the establishment of cooperative trust relationship between multiple parties, and achieve win-win cooperation; Accelerate the construction of a comprehensive data system in the medical field; It has increased the combination and application of 5G, big data, artificial intelligence and blockchain technologies, and established a more secure and effective service system.

(3) Analysis of rural medical system service model based on blockchain

Using the convenient, efficient and flexible service model of blockchain, medical records can be viewed, questioned, printed and other operations at any time according to the patient's own situation, without relying on other institutions, and do not need to repeatedly go to the hospital to provide relevant supporting materials; medical records collected based on big data technology; Use blockchain technology to make drug circulation data transparent and realize drug traceability; Promote a variety of digital transmission technologies to establish links between medical institutions in other regions, patients and doctors, and easily complete teletherapy, consultation, teaching and communication tasks; Using blockchain technology and big data analysis technology, the patient's physical condition, dietary advice, healthy body side and other information are observed through the mobile terminal.The specific model is shown in the following figure:

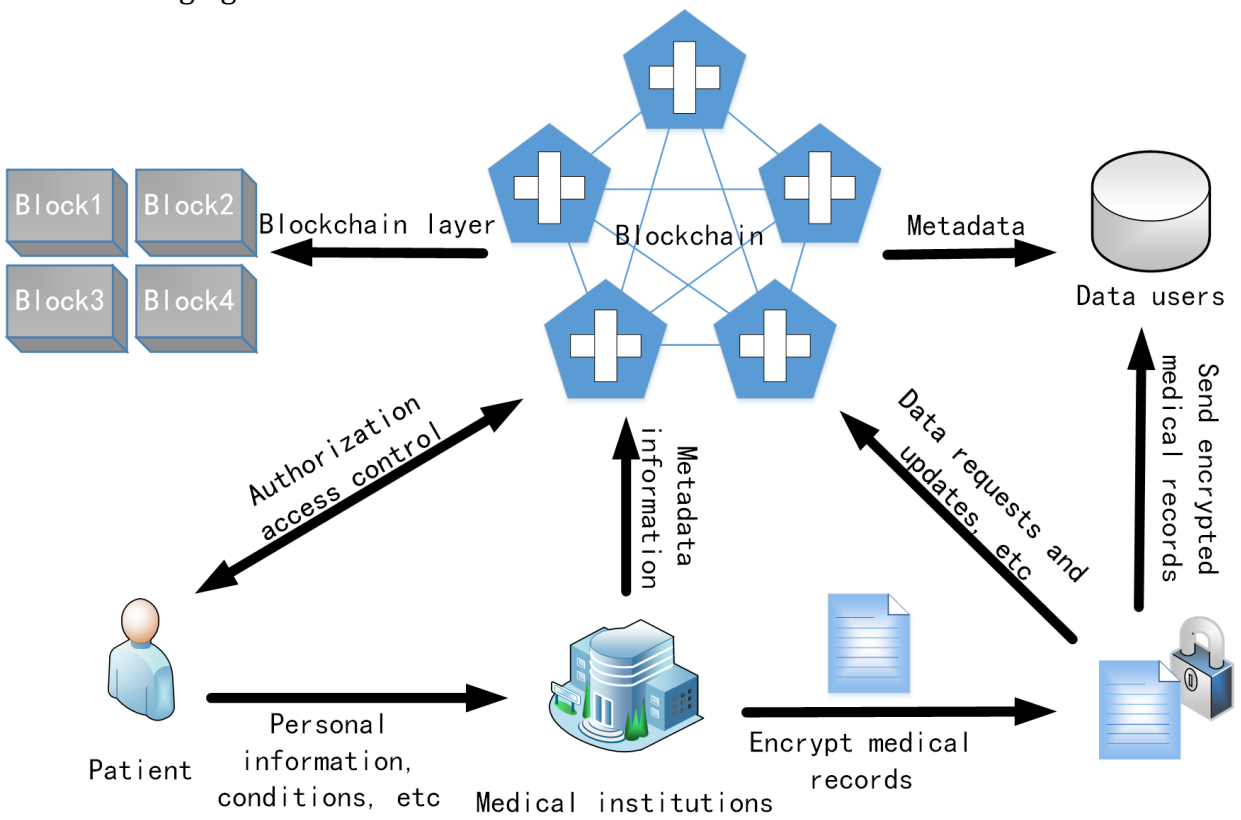

Figure 1: Blockchain + medical model

ISSN: 2664-9640

2.3. Innovation and characteristics

2.3.1. Innovation

(1) Hybrid encryption in providing security: the use of simple encryption mechanism to store, encrypt original medical data and distributed database, there are very big security risks, and we combine blockchain technology and cloud storage technology, using a hybrid encryption mechanism of the two to protect the privacy of medical data, further making this model reliable in privacy protection

Sex. At the same time, it can be combined with cloud storage and hybrid encryption mechanisms to protect the privacy of medical and health data.

(2) Telemedicine is more reliable: It is realized through the unique decentralized characteristics of blockchain technology, avoiding the possibility that special sensitive information related to patients and health is leaked due to internal errors or external attacks on the previous telemedicine platform. Use blockchain technology to protect users' privacy on an open and transparent basis.

(3) Have a comprehensive and complete electronic medical record: patients as data subjects can have their own medical and health information, and changes anywhere will be recorded on the blockchain in chronological order, ensuring the effective flow of data and ensuring the patient's right to know their own data.

2.3.2. Characteristics

(1) Start from the countryside. It can promote the establishment and improvement of the rural medical service system, so as to improve the level of the public service system required for rural revitalization and promote the new path of innovative development of rural areas.

(2) The research results are replicable and generalizable. By relying on the high credibility and integrity of blockchain technology, it promotes the interoperability and sharing of medical data, data security, and establishes a more convenient and efficient medical resource service sharing platform, so that it can be more reasonable and widely used in the field of smart healthcare; In the near future, a new channel will be established that can combine the medical service industry with blockchain technology, connect all important medical information resources, and improve the sharing and privacy of data. It is more instructive for the development of medical care in other regions.

(3) The market prospect is huge. The state's support for blockchain medical policies, people's growing medical needs, and the superiority of blockchain technology make blockchain medical care an important part of promoting medical reform.

3. Conclusion

As a technology, the decentralization, secure sharing, non-tampering and high privacy characteristics of blockchain provide a new perspective for breaking through the bottleneck of the current development of rural hospital management informatization. The application of blockchain can cover all aspects of hospital management such as process, supervision, statistics, finance, auditing, and archives, and provides practical technical support for reconstructing the foundation of hospital informatization and reshaping the process of hospital management. It is foreseeable that blockchain technology will reshape the future of rural medical industry informatization.

ISSN: 2664-9640

Project Fund

This article is funded by the Innovation and Entrepreneurship Training Program of Anhui University of Finance and Economics. Project name: Research on rural medical service system based on blockchain. Project No: S202210378256.

References

[1] Agbo C C, Mahmoud Q H, Eklund J M. Blockchain technology in healthcare: a systematic review[C]//Healthcare. MDPI, 2019, 7(2): 56.

[2] Ali Aitizaz,Pasha Muhammad Fermi,Ali Jehad,Fang Ong Huey,Masud Mehedi,Jurcut Anca Delia,Alzain Mohammed A.. Deep Learning Based Homomorphic Secure Search-Able Encryption for Keyword Search in Blockchain Healthcare System: A Novel Approach to Cryptography[J]. Sensors,2022,22(2).

[3] Elvas L B, Serrão C, Ferreira J C. Sharing Health Information Using a Blockchain[C]//Healthcare. Multidisciplinary Digital Publishing Institute, 2023, 11(2): 170.

[4] Xue Tengfei, Fu Qunchao, Wang Feng, Wang Xinyan. Research on Medical Data Sharing Model Based on Blockchain [J]. Acta Automatica Sinica,2017,43(09):1555-1562.

[5] Zhou Lijing. Research on key technologies of blockchain privacy[D].Beijing University of Posts and Telecommunications,2019.

[6] Hu Qinghan,He Juan,Dong Qing. Research on Information Management of Medical Epidemic Prevention Emergency Material Supply under Blockchain Architecture: A Case Study of Targeted Donation of Novel Coronavirus Pneumonia Epidemic Prevention Materials in China[J]. Health Economics Research,2020,37(04):10-14.]

[7] DIing Yangjun, QIian Gang. Research on Secure Storage of Electronic Medical Records Based on Blockchain [J]. Computer Age,2023,(03):88-92+96.