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Comprehensive Review of Block Chain Technology Based Electronic Healthcare Record System in Perspective of Security

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Abstract

The current decade of the internet creates a diverse space of distributed computing and data accessibility over the globe. The applicability of the internet in medical record-keeping plays an important role. The medical record-keeping from digital recording reduces the cost of data storage and improves the performance of data available for patients, doctors, and other organizations for research and analysis. The blockchain technology provides the platform to store and retrieve data with transparency immutable and secured over the internet. The protocol stack of blockchain technology uses various cryptography and hash function for the encryption of recoding and hash index for the record submission and retrieval. The working fashion of blockchain technology is distributed and incorporated by various health industries. The formation of electronic health recodes based on blockchain technology drives the new age of health care industries and promotes the concept of telemedicine. The integrity of the health care record is real sensitivity. Due to this reason, various authors and researchers focus on network and data security in concern of blockchain technology. This paper presents the review of current trends of blockchain technology with security challenges.

Keywords: - Blockchain HER, Security, Health Industries, Network Security, Cryptography.

Introduction

The growing rate of health care record needs massive storage and security for privacy and sensitivity of data. The ample storage required the information technology models for storage, such as client-server, centralized, and distributed systems. The concept of distributed computing provides the cloud data storage concept and utility[1]. The primary issue related to healthcare data is the privacy of patients' information with permission to disclose to others. The facility of electronic health records enhances the capacity of medical disease analysis and service to society. The quality of medical health records is challenging due to the transmission of the medical history of patients. Due to the process of compression algorithm, the loss of sensitive data[2, 3]. In current scenario of electronic health record adopt the blockchain technology. The blockchain technology provide the new milestone for electronic health record. The characteristics of blockchain technology such as transparency, immutable and distributed sharing of data benefitted to the concept of electronic health record. The access of blockchain technology-based network data through role based. The policy of access role in blockchain technology has very users have certain role and responsibility for accessing of data[4]. The role-based policy needs the authentication and authorization process for sharing of data over the internet. For the process of authentication and authorization used the concept of public and private cryptography. The process of cryptography generates the concept of key based data sharing and storage. The major disadvantage of blockchain technology and smart device enabled data access is security, privacy and scalability. The major gap of current system of electronic health record system and integration with blockchain technology is interpretability[5, 6, 7]. Various authors and researchers proposed various algorithm for interpretability and security of user access of blockchain network-based data. The purpose of this study is present the concept review of cryptography algorithms in blockchain technology[8].

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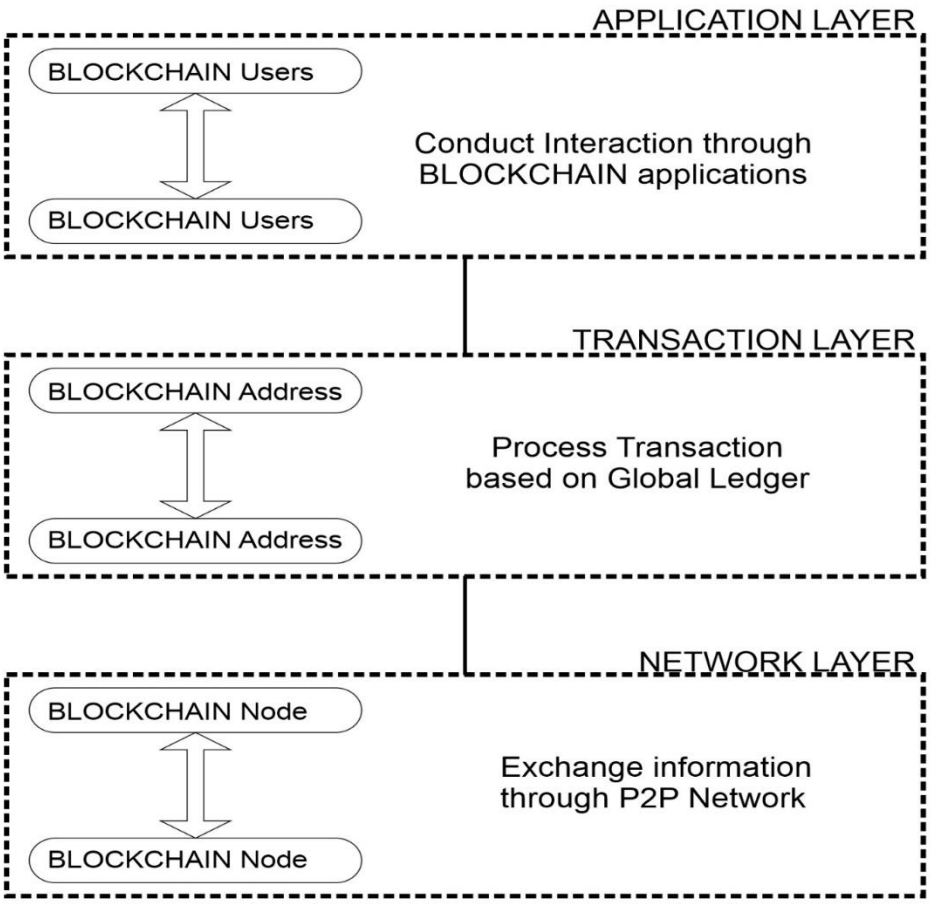

Figure 1: Process block diagram of block chain technology for electronic healthcare system.

II. Related work

In this section describe the current work related to security in scenario of blockchain technology. The gap of security in blockchain technology defame the impact of electronic health recode. The work of security and application in blockchain technology discuss here.

Tanwar, Sudeep, Karan Parekh, and Richard Evans Et al. [1] a few answers for improving current constraints in human services frameworks utilizing blockchain innovation are investigated, including structures and instruments to gauge the exhibition of such frameworks. Execution measurements in blockchain systems, for example, inactivity, throughput, RTT (*Round Trip Time*). have additionally been advanced for accomplishing improved outcomes. Contrasted with customary EHR frameworks, which use customer server engineering, the talked about framework utilizes blockchain for improving efficiency and security.

Hathaliya, Jigna, Priyanka Sharma, Sudeep Tanwar, and Rajesh Gupta Et al. [2] Authors give experiences to the blockchain-based RPM framework for social insurance division. The study is by companioning it with existing best in class draws near. The second piece of the study, introduced the blockchain-based framework engineering to defeat the security and protection issues of conventional framework. The third piece of the study, concentrated on the different difficulties of the blockchain. At long last, creators featured different exploration difficulties of blockchain in social insurance division.

Hathaliya, Jigna J., and Sudeep Tanwar Et al. [3] writers give bits of knowledge to the perusers about the security and protection issues of Healthcare 4.0. The review is separated into four sections. The initial segment talked about the foundation and history of human services to sum things up. Human services history is examined dependent on year-wise

enhancements and advancement in security arrangements. The subsequent part outlines the essential and advance design with conventional security techniques and blockchain innovation, separately. The third part portrayed the scientific classification of security and protection issues of Healthcare 4.0. It covers all parts of human services, for example, preparing, WD, IoT, ML, Telehealth-care, and strategy based, arrange traffic, and verification plot.

Bhattacharya, Pronaya, Sudeep Tanwar, Umesh Bodke, Sudhanshu Tyagi, and Neeraj Kumar Et al. [4] The move of clients and administrations in the Healthcare 4.0 requests decentralization and simultaneously gives essential necessities of client security and secrecy. The talked about engineering BinDaaS gives a coordinating system to guarantee security through blockchain and furthermore gives future hazard forecast of infections of patient with the goal that exact anticipations for basic disease can be taken consideration to spare valuable existence of patients. BinDaaS addresses three key commitments Integrating DL and blockchain to safely store the patient EHR information and gives future expectations dependent on past storehouses, A grid-based key and mark confirmation plan to oppose quantum assaults and approval of the security plan and forecast model against existing best in class foundations. Security assessment is planned on Lattice cryptosystem and is broke down dependent on calculation and correspondence cost.

Gupta, Rajesh, Sudeep Tanwar, Sudhanshu Tyagi, Neeraj Kumar, Mohammad S. Obaidat and Balqies Sadoun Et al. [5] creators talked about, a system named as HaBiTs, where security can be accomplished with unchanging nature and interoperability by Smart Contracts (SCs). SC is a bit of code written in robustness or other blockchain explicit dialects to build up the trust b/w all the gatherings associated through blockchain and furthermore kill the need of a delegate for information sharing. At long last, creators feature a few issues of the conventional telesurgery framework and how they are moderated with use of the examined HaBiTs structure.

Faramondi, Luca, Gabriele Oliva, Roberto Setola, and Luca Vollero Et al. [6] The blockchain innovation depends on cryptography and circulated agreement to ensure information respectability, responsibility and security. The abuse of such innovation is considered in this section, indicating the points of interest when utilized in a H4.0 situation. In this report creators talk about the qualities of Hospital 4.0 and Blockchain, and the use of the Blockchain innovation in Hospital 4.0 for the powerful administration of EHRs. The attributes of blockchain, particularly the inconceivability to change information without being followed back, permit the vigorous administration of information, ensuring honesty against assaults and blames. In the long run, a selection at a national/provincial level could permit compactness of EHRs, encouraging and cultivating safe correspondences among various Hospital reality.

Chen, Yi Et al. [7] Sharing and utilization of individual clinical information are fundamental for clever medication. It is hard for patients to secure all their clinical records from various clinical organizations they have visited. Breaking the data island marvel in clinical information is a pressing issue that needs an answer. Meanwhile, putting away, sharing and applying clinical information is fundamental in circumstances where security and protection are ensured. The blockchain is seen as a capacity flexibly chain in which each activity might be confirmed, responsible and changeless. Such natural qualities make it an expected answer for medicinal services information frameworks that worries both sharing and patient security.

Mackey, Tim K., Tsung-Ting Kuo, Basker Gummadi, Kevin A. Clauson, George Church, Dennis Grishin Et al. [8] Blockchain is a common conveyed advanced record innovation that can all the more likely encourage information the executives, provenance and security, and can possibly change medicinal services. Critically, blockchain speaks to an information engineering, whose application goes a long way past Bitcoin the digital money that depends on blockchain and has advocated the innovation. In the wellbeing part, blockchain is as a rule forcefully investigated by different partners to enhance business forms, lower costs, improve quiet results, upgrade consistence, and empower better utilization of medicinal services related information.

Al-Jaroodi, Jameela, and Nader Mohamed Et al. [9] A wide scope of mechanical spaces are beginning to embrace blockchain to encourage their activities with the primary goals of smoothing out procedures, improving security and information sharing, expanding the productivity and at last lessening expenses to increase an upper hand. The primary empowering influences or these applications is the presentation of computerized characters, conveyed security, keen agreements and miniaturized scale metering through the dispersed blockchain records. Thus, applications in the money related, vitality, co-ordinations, medicinal services and assembling spaces are developing and ending up being extremely helpful.

Hussien, H. M., S. M. Yasin, S. N. I. Udzir, A. A. Zaidan, and B. B. Zaidan Et al. [10] The fundamental commitment of this investigation is the extensive overview and arrangement of suitable exploration articles on blockchain and their combination into various human services applications, where specific writing patterns are watched. Blockchain stage gives the improvement of a decentralized application, wherein the example of information exchanges is uncontrolled by any mediator association. The elements information exchange is put away in a decentralized database in a certain, safe, unchanging and straightforward way with time stamp and other pertinent subtleties. Blockchain innovation additionally offers the open door that could be utilized in social insurance applications for some planned usage. In the beginning periods of structure and improvement, numerous investigations have talked about arrangements that can possibly expand human services information straightforwardness and working effectiveness.

Hathaliya, Jigna J., Sudeep Tanwar, and Richard Evans Et al. [11] In this work, creators talked about a versatile based way to deal with making sure about electronic medicinal services records. The methodology is partitioned into seven sections. The first talked about the framework engineering, while the second portrayed the security discoursed of the examined approach. In the third part, creators portrayed the calculation for giving access rights to patients, specialists and administrator staff. The fourth part portrayed the capacity of the talked about way to deal with oppose assaults, satisfying security necessities. At that point, security investigation of the star presented verification approach is talked about.

Ringer, Liam Et al. [12] There are a few zones of medicinal services and prosperity that could be upgraded utilizing blockchain advances. These incorporate gadgets following, clinical preliminaries, pharmaceutical following, and medical coverage. Inside gadget following, medical clinics can follow their benefit inside a blockchain framework, including through the total lifecycle of a gadget. The data accumulated would then be able to be utilized to improve tolerant wellbeing and give secondary selling examination to improve productivity reserve funds. Confirmations of idea have been created which bring blockchain advances into the social insurance industry anyway there are as yet numerous hindrances to selection. One of the most noteworthy boundaries will be the characteristic obstruction of the medicinal services industry to change its current practices,40 particularly identifying with authoritative, auxiliary, mechanical and human variables.

Miraz, Mahdi H., and Maaruf Ali Et al. [13] The Blockchain itself and its variations are currently used to make sure about an exchange, regardless of whether it be human-to-human interchanges or machine-to-machine. Its appropriation has all the earmarks of being secure particularly with the worldwide rise of the Internet-of-Things. Its decentralized application over the effectively settled worldwide Internet is additionally engaging as far as guaranteeing information repetition and consequently survivability. The Blockchain has been particularly recognized to be appropriate in creating countries where guaranteeing trust is of a significant concern. Therefore, the innovation of the Blockchain can be believed to be an indispensable and truly necessary extra part of the Internet that was inadequate in security and trust previously. BC innovation despite everything has not arrived at its development with a forecast of five years as novel applications keep on being executed universally.

Rahman, MD Abdur, M. Shamim Hossain, George Loukas, Elham Hassanain, Syed Sadiqur Rahman Et al. [14] Authors present a protected treatment structure that will permit a patient to claim and control his/her own information with-out any confided in outsider, for example, a treatment place. With the help of blockchain, the system will be resistant to a solitary purpose of disappointment or unapproved get to. The restorative information will be unchanging, unknown, secure, and straightforward to the network of intrigue. The patient can share the treatment history and nature of-progress information with any-one the person needs. Through a MEC arrange, the treatment system can stay away from the deficiencies of the high data transfer capacity and investigative preparing need of the cloud by supporting significant handling at the edge organize.

Vora, Jayneel, Anand Nayyar, Sudeep Tanwar, Sudhanshu Tyagi, Neeraj Kumar, Mohammad S. Obaidat and Joel JPC Rodrigues Et al. [15] By utilizing the figure supervisor, and consolidating the utilization of encryption strategies before sending and getting the records over the system, the likelihood of unapproved utilization of the records is limited. Every patient has a special Ethereum address and identifier, which makes the distinguishing proof a dull errand for an unapproved client. The utilization of different agreements as depicted to give a feeling of seclusion further makes the structure achieves a more significant level of information security. Utilizing numerous agreements for execution of the full hub can thus prompt more interest on the enrollment procedures and customs during exchanges.

Verdonck, Michaël, and Geert Poels Et al. [16] This work means to offer an elective plan to oversee EHRs with blockchain innovation. All the more explicitly, the accentuation of their structure centers around embracing blockchain and keen agreements as an authorization the executive's database and motor. creators give a general outline of the design of their blockchain-based EHR authorization the board framework and portrays the worth trades that occur between the various gatherings taking part in the EHR eco-framework in which their blockchain-based framework is to be executed.

Alladi, Tejasvi, Vinay Chamola Et al. [17] creators extensively survey existing blockchain applications in Industry 4.0 and $IIoT$ settings. In particular, creators present the ebb and flow research drifts in every one of the related mechanical areas, just as effective advertisement usage of blockchain in these applicable divisions. creators additionally talk about industry-explicit difficulties for the usage of blockchain in every segment.

Siyal, Asad Ali, Et al. [18] Blockchain innovation has increased extensive consideration, with a heightening enthusiasm for a plenty of various applications, extending from information the board, money related administrations, digital security, IoT, and food science to human services industry and cerebrum research. There has been an amazing interest seen in using utilizations of blockchain for the conveyance of protected and secure human services information the board. Likewise, blockchain is changing the conventional medicinal services practices to a progressively solid methods, as far as viable determination and treatment through protected and secure information sharing.

Khatoon, Asma Et al. [19] In this work, creators survey existing writing and applications accessible for the human services framework utilizing blockchain innovation. Moreover, this work additionally examined numerous work processes associated with the medicinal services environment utilizing blockchain innovation for better information the board. Diverse clinical work processes have been planned and actualized utilizing the ethereum blockchain stage which includes complex clinical methodology like medical procedure and clinical preliminaries. Inside the usage of the work processes of the clinical savvy contract framework for social insurance the executives, the related expense has been assessed for this framework as far as a possibility study which has been extensively introduced in this work.

Zhang, Mian, and Yuhong Ji Et al. [20] Many hindrances should be defeated before blockchain can be completely received as a standard innovation for certifiable business arrangements. Beside the issues within the blockchain innovation, an absence of guidelines, the requirement for off-chain advancement of open framework interfaces, and having delegates who right now benefit from controlling the information to interface with blockchains are for the most part obstructions to the appropriation of blockchain framework. The vast majority acknowledge and comprehend the difficult issues in current social insurance industry. One way that has been utilized is that blockchain system could dole out more weight into confided in hubs to speed up the calculation of the square. Social insurance information has its worth, especially with an enormous size of information pool. Blockchain token can be utilized to boost the information contributors. It is essential to have a motivation component as an implicit element of the framework to control the working of the chain. Manufacture an application that permit patients to give their information in an unknown manner. The estimating model for different classifications of information should be made sense of.

Abdellatif, Alaa Awad, Abeer Z. Al-Marridi, Amr Mohamed, Aiman Erbad, Carla Fabiana Chiasserini and Ahmed Refaey Et al. [21] creators imagined a novel e-wellbeing framework for making successful, enormous scope and community-oriented frameworks ready to give great patients care and to make huge headways in infection medicines through secure information sharing. The examined ssHealth framework coordinates edge figuring and blockchain to empower the trading of enormous measure of clinical information created by various social insurance elements, while saving the patient's protection. Also, creators characterized a novel instrument that can be executed inside the blockchain system to guarantee quick reaction, versatility, and secure transmission of clinical information.

Dwivedi, Ashutosh Dhar Et al. [22] In this work, creators presented a novel half breed approach that consolidates the benefits of the private key, open key, blockchain and numerous other lightweight cryptographic natives to build up a patient-driven access control for electronic clinical records, fit for giving security and protection. creators likewise bring up open issues to diminish different assaults, for example, DoS, change assaults and so on.

III. Comparative Analysis of Blockchain Adoption

Sr. No.	Entities	Blockchain	Description	Validation
1.	Patients Hospitals	Private (Ethereum) Consensus: Practical Byzantine Fault Tolerance (PBFT)	Blockchain system links patients with doctors using customized smart contract to record all events on the blockchain	Latency scalability
2.	Patients Hospitals Medical labs Insurance companies	Private (Ethereum) Consensus: Proof of Work (PoW)	A blockchain framework is proposed for searching encrypted index of Electronic Health Records (EHRs) while real data stored in database	Scalability
3.	Patients Hospitals Healthcare communities Researchers	Private (consortium) Consensus: delegated proof of stake (DPoS)	Parallel healthcare system using blockchain, technology is proposed to link various parties for medical data sharing	Latency scalability security
4.	Patients Hospitals Healthcare institutions	Private (Ethereum) Consensus: PoW	Blockchain framework is proposed to connect the patients with the hospitals to enable health-related information exchange	Scalability
5.	Patients Healthcare providers	Private (Hyperledger fabric) Consensus: Byzantine fault-tolerant state machine replication	Blockchain framework is proposed for sharing processed medical data between different healthcare entities	Scalability Patients approval
6.	System manager Hospitals	Private (Ethereum) Consensus: proof of conformance	Framework of dual blockchains is proposed, one to store and share the index of the EHR with multiple hospitals, and the other to store the original data	Storage scalability

7.	Patients Medical institutions	Public (Ethereum) Consensus: PoW	Propose a framework of two coupled blockchains for managing the storage of two types of data to enhance the throughput, accessibility, and fairness among users	Latency scalability computational cost
8.	Patients Hospitals Research institutions	Private (MeDShare) Consensus: using consensus nodes	Blockchain system is proposed to provide medical data sharing, auditing, and control over diverse entities	Privacy scalability
9.	Patients Doctors Insurance companies	Private (Hyper ledger fabric) Consensus: voting-based approach	Blockchain has been integrated with a tree-based method for medical data sharing between different entities	Privacy scalability

Table 1: Summary of The Relevant Work on Blockchain In Healthcare Systems.

IV Conclusion & Future Work

This paper presents the review of blockchain technology in adoption of electronic health record. The adoption of blockchain technology in this area improve the accessibility of data for the purpose of telemedicine and review of medical history. The major issue in current system is authentication and authorization of user for access of data. The privacy of data regarding patient's history is major challenge. For this challenge various authors used the concept of public and private cryptography algorithms. The uses of cryptography algorithms create load of CPU and increase the traffic of network. The increased load of traffic degraded the performance of current system. In future proposed cyclic prefix-based cryptography algorithm for electronic health record system in blockchain technology.

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