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A Survey on Decentralized e-health record with health insurance synchronization

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Abstract**—** *In the medical field, electronic health records (EHR) serve a critical function that benefits both healthcare providers and patients. Many cloud-based solutions for medical record exchange have been offered, but the credibility of a third-party cloud service is questioned due to the centralized approach. As a result, a decentralized blockchain system for sharing electronic health records has been established that does not rely on third-party services. Existing services, on the other hand, exclusively collect data from medical tests. They are ineffective at sharing data streams that are continuously created by various sorts of devices. The information gathered is shared with laboratories and medical institutions for future research. Furthermore, current techniques are too rigid to accommodate metadata modification effectively. Decenrod proposes a medical data-sharing scheme that combines blockchain, electronic health records, and a structured peer-to-peer network based on InterPlanetary File System (IPFS) techniques to address the above efficiency issues in existing medical data-sharing and storage services. A session-based healthcare data-sharing strategy has been designed, according to Decenrod, which allows for more flexibility in data sharing. According to the evaluation results, Decenrod can improve efficiency and meet security criteria in data exchange by implementing Decentralized EHR. The information gathered is shared with laboratories and medical institutions for future research.*

Keywords**— health insurance system, e-health,**

I. INTRODUCTION

Blockchain technology could rehabilitate the electronic health record (EHR) by increasing the efficiency, security, and privacy of EHR sharing platforms over a peer-to-peer network. Traditional security is centralized, whereas blockchain is a decentralized database. The limitations and complexity faced by the centralized database approach are overcome by using the decentralized database approach. By using the decentralized database approach, we are introducing the health insurance concept along with this technique.

The data stored in the decentralized blocks of the blockchain remains more secure, and no unauthorized users can access the data without the knowledge and authentication given by the client. All the data stored in the node can be used by other nodes, so if any one node of the network chain is corrupted or any error occurs in the node, that particular node alone becomes dysfunctional; hence, with the help of the remaining nodes, we can retrieve the data and make the network chain efficient. The client can access their stored medical records from anywhere at any time using this type of EHR (Electronic Health Record), and they can also grant authentication (permission) to whomever they want to see their records.

A centralized electronic health record system is a core system emanating across developed countries to help improve health systems and better deliver health care. Apparently, its introduction is somewhat limited to very few parts of the world; however, its full potential has yet to be maximized due to the reluctance of many nations to consider it. Furthermore, this article emphasizes the critical role of centralized health systems in overcoming inefficient health care systems, highlighting the challenges faced by nations with the lowest Human Development Index, and discusses why employing these systems is critical for achieving an optimized health care system that will be well-

equipped to stop any potential outbreak from spreading even before it begins.

Due to numerous data breaches caused by the centralized EHR, health data management and security have become increasingly crucial. EHR is not tamper-proof because it is centralized. This will influence patients in a variety of ways, including their trust in the organization's ability to protect their health information. Human trafficking is common these days, especially for rare blood groups and organs. This occurs as a result of a data breach in hospital patient medical records.

To prevent tampering, i.e., in order to secure the information that has already been stored, the user handles grant and revocation concepts. Key generation processes employ advanced cryptography techniques. Point-of-care genomics management is a concept used for identifying genetic diseases. So we use the InterPlanetary File System (IPFS), which is a distributed file system protocol and peer-to-peer network for storing and distributing data. Each file in IPFS is uniquely identified using content addressing in a global namespace that connects all computing devices. Medical professionals would be able to control the flow of data from a single, dependable platform with blockchain-based electronic health records. Blockchain solves the interoperability problem by allowing healthcare providers to store data in a single location that can be distributed to all network nodes.

II. LITERATURE SURVEY

Blockchain technology was designed by A. A. Mamun, S. Azam, and C. Gritti [1]. The core idea was to create a decentralized currency that was cryptographically secure and beneficial for financial transactions. This blockchain concept was eventually used in a variety of other fields, including the healthcare sector. A number of researchers have conducted research in this area; these studies focus on whether the idea of using blockchain in the healthcare sector is feasible or not. They also identify the advantages, threats, problems, and challenges associated with the usage of this technology. Some researchers have addressed the difficulties of really putting this into practice on a larger scale.

Gordon and Catalini [9] conducted a study that emphasized the ways in which blockchain technology might benefit the healthcare industry. They identified that the healthcare sector is controlled by hospitals, pharmaceutical companies, and other involved third parties. According to them, the purpose of using blockchains in healthcare is data sharing. This study also identified four factors or approaches due to which the healthcare sector needs to transform for the use of blockchain technology. These include ways for dealing with digital access rights, data availability, and faster access to clinical records and patient identity. Additionally, it involves both on-chain and off-chain data storage. The study also included the challenges or barriers faced by the usage of blockchain technology: huge volumes of clinical records, security, privacy, and patient engagement.

M. Hochman [10] conducted a study to understand possible approaches to solving the scalability problem of blockchain and to identify projects that intend to solve this problem. Blockchain is described as the combination of different computational and economic principles built on a peer-to-peer network. Finding out which data should be saved on-chain and which can be stored off-chain was the goal of this study. This study presented five patterns for off-chain storage of data and also included the basic ideas and implementation framework of these patterns. On-chain data is saved on the blockchain by carrying out transactions on it, according to the authors. In order to store data off-chain, it must be done on a different storage medium and not involve any transactions.

Z. Zheng, S. Xie, H. Dai, X. Chen, and H. Wang [11] presented an overview of blockchain technology, bitcoin, and Ethereum. The authors define that the information technology landscape is constantly changing and that blockchain technology is benefiting information systems. They described bitcoin as a decentralized peer-to-peer network utilized for bitcoin transactions. They also defined the proof-of-work consensus algorithm along with the mining of the blockchain concept. The authors emphasize the fact that scalability is a severe problem faced by blockchain and that certain solutions are proposed for the solution of scalability problems, including SegWit and Lightning, Bitcoin Cash, and Bitcoin Gold. The paper also explained Ethereum and its dependencies and differentiated the Ethereum blockchain from the Bitcoin blockchain.

T.-T. Kuo, H.-E. Kim, and L. Ohno-Machado [12] conducted a study that focused on smart contracts and their application in blockchain technology. They first introduce smart contracts, their working framework, operating systems, and other important concepts attached to them. The authors also discuss how smart contracts could be used for the new concept of parallel blockchains. They identify that the reason for using smart contracts in the blockchain is due to the decentralization that is offered through the programming language code written in them. After introducing the basics of smart contracts, the author explained the various layers of blockchain that combine to keep the system functioning. These layers are the data, network, consensus, incentive, contract, and application layers. The paper not only discusses the architecture and

framework that smart contracts use, but it also discusses their applications and challenges. The paper also discusses an important future trend of parallel blockchains, which intends to create a blockchain that can optimise two different but important modules.

J. eAmer. [13] conducted a review that discussed several applications of blockchain in the biomedical and healthcare sectors. The authors identified that using blockchains for this domain offers many advantages, and some of these are decentralization, persistence of clinical or medical records, data pedigree, continuous accessibility to data, and secure information being accessible to biomedical or healthcare stakeholders. The authors identified the limitations of blockchain technology as confidentiality, speed, scalability, and the threat of malicious attack; i.e., these limitations are critical for the healthcare or biomedical sector because they are used to store sensitive medical or clinical records. The authors proposed a solution to these issues: store sensitive medical data off-chain and encrypt the data to ensure its security.

A. Azaria et al. [14] have proposed a scalable blockchain framework leveraging the Hadoop database. They suggested combining the decentralization offered by blockchain technology with the scalability offered by the underlying Hadoop database to address the scalability issue with blockchain. In order to increase the scalability of the blockchain technology, they used a mechanism to store blocks on the Hadoop database. All blockchain dependencies are included in the blockchain built on top of this framework. In order to address the scalability issue of blockchain systems, this study proposes the use of the Hadoop database system in conjunction with SHA-256 for hashing used for transactions and blocks. The results of this study helped us understand how blockchain can be utilized in conjunction with other scalable platforms to enhance or address this platform's scalability.

L. A. Linn et al. [15] presented a scalable remedy for the blockchain's use in clinical records. Designing an architecture that meets the Office of National Coordinator for Health Information Technology (ONC) criteria was the main goal of this study. This study determined the main challenges this technology faces, including worries about privacy, blockchain security, scalability issues related to the massive volume of datasets being transmitted on this platform, and lastly, the absence of a globally enforced standard for data exchange on blockchain. This study also features a demonstration of a decentralized application (DAPP) built on a design developed in accordance with the previously specified ONC specifications. The lessons learned and suggestions for enhancing the FHIR chain were also included.

Kunal Dhariwal. [16], proposed a system for the management of medical questionnaires, and therefore the aim of this system is knowledge sharing through blockchain technology. The authors justify their decision to store and share knowledge via medical questionnaires by stating that this knowledge will be used for additional medical and clinical analysis functions. They emphasized that it could be useful in developing diagnostic systems; partitioning terminologies used in EHR systems; and security issues associated with these systems were also reasons why the authors chose blockchain technology for their planned framework. This study contains two main functions, i.e., to create, store, and share the knowledge gathered by questionnaires. Another profit planned by the system is the validation of the form being submitted. The forms that are additional to this system are initially valid because they are in the right fixed format, then they are parsed to differentiate the private knowledge and specific knowledge associated with questionnaire results. This ensures that knowledge can be shared for future analysis functions. The authors also address the situation when a third party requests access to this type of knowledge; this would require the patient's permission, which is requested by the doctor, to allow the third party to read that knowledge.

A. A. Vazirani [18] conducted a review that included several uses of blockchain in the biomedical and healthcare industries. The decentralization, durability of clinical or medical records, data pedigree, ongoing access to data, and last but not least, safe information being accessible to biomedical or healthcare stakeholders, are some of the benefits the authors identified with employing blockchains for this sector. The speed, scalability, potential of malicious attacks, and threat of a 51 percent attack were mentioned as the blockchain technology's limits. These restrictions were deemed crucial by the authors for the healthcare or biomedical industries because they are being used to keep private medical or clinical records. Authors offered data encryption as a remedy to these issues, recommending off-chain storage of private medical information.

III. CONCLUSION

In conclusion, blockchain technology is advantageous in a range of social insurance scenarios, such as those involving critical attention, restorative data inquiry, and associated wellness. We discussed how maintaining a permanent, straightforward document that captures every event that occurred while using the device could enhance and motivate the management of remedial records. Medical scans offer useful information from which valuable inferences can be drawn, resulting in the provision of valuable findings. By using time-based smart contracts to manage transactions

and enforcing acceptable usage restrictions, the medical chain maintains privacy by keeping track of the calculations made on EMRs. The integrity of data is ensured by the use of hashing algorithms. Access control and security are maintained by the deployment of advanced encryption. By implementing cutting-edge encryption and authentication methods across the blockchain, security and access control are maintained. Comprehensive logging is used to enable interoperability, auditability, and accessibility. Our plan is independent of any one system, and its modifications might be able to work with other, comparable systems that allow numerous users to access electronic records. Since medical records are the patients' property rather than a coin or digital currency that can be sold, this study proposes a novel incentive mechanism in conjunction with the POA for mining. It makes use of the importance or extent to which providers are contributing to the upkeep of patient files and the construction of new blocks. Since the majority of current healthcare providers are welfare-oriented and do not intend to include any monetary value, our mechanism rewards the "block's creator" with an incentive to be added to its degree, thereby lowering the likelihood that it will create the next block instead of just producing digital money. Consequently, achieving equity and justice among providers and maintaining the system's sustainability Results show how effectively our proposal handles a big dataset with low latency.

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