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HEALTH RECORD MANAGEMENT THROUGH BLOCKCHAIN TECHNOLOGY

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ABSTRACT: We built a Web 3.0 system to validate student logins and grant data access rights. This system made use of the BSC, Metamask, Web3 module, and React technologies. Use the student wallet addresses to log in. This method is compatible with Metamask. The study demonstrates how wallets can be used to authenticate users while also acting as user credentials and permission agents utilizing blockchain technology. Our product has a functional prototype. We do not use it since it requires adjustments to the college system. We are unable to track transactional trends due to blockchain's restricted data processing capabilities. We want it to evolve and become more comprehensive so that institutions can use it. To encourage more people to utilize BSC, all network transactions on the campus network will be tokenized. *Index Terms*—Decentralized, Blockchain, Immutability, Cryptographic hash, Smart contract.

1.INTRODUCTION

Improving people's health is crucial for society's overall well-being as well as their individual enjoyment. The most important thing is that the economy of the country grows. Every day, everything from medical emergencies to ordinary events occur that require immediate attention and resolution. A person's health record is a compilation of all medical information on their physical and mental health that has been gathered from various sources. A person's health record contains all of their medical history, including physical exam results, documented diagnoses, prescribed treatments, and crucial notifications, such as allergy information. There are physical as well as electronic methods for keeping track of these medical records. A significant portion of hospitals still maintain their information on paper, using paper-based systems and books. There are also significant issues with the system under consideration, such as the fact that it requires a lot of storage space and is difficult to obtain documents from. The aim to make it easier to store and find copies of these information is driving the increased computerization of clinical data. Influence problems that cannot be solved have become serious difficulties. If someone has unauthorized access to a patient's medical information, that person may sue both the doctor and the hospital for negligence.





Fig.1. The health-care equipment is already in place and centralized.

When paper-based medical records are not used appropriately, they can occasionally result in unnecessary medical exams and pharmacological treatments. Because we are dispersed, sending records by mail or fax necessitates more work that must be done by hand, which takes time. Doctors are also having difficulty accessing patient records. The usage of digital tools in healthcare allows medical providers to share patient records more easily and quickly. There are numerous issues with this, including where to store patient data, how to ensure that only authorized persons have access to it, how to keep it safe, and how to ensure its accuracy. The challenges described above can be successfully mitigated by implementing a decentralized digital health infrastructure or incorporating Blockchain technology into the healthcare system. Blockchain technology has the potential to totally transform the way the modern economy operates by upgrading documentation.

The essay then discusses what follows: Part IIB provides a quick summary of the difficulties and potential solutions in the field of Blockchain technology, and Part III is all about handling decentralized medical data. Section IIA delves deeply into Blockchain technology. There are a few final observations at the end of Section IV.

2.BACKGROUND

Blockchain Technology

A blockchain is a constantly increasing record of events that has the properties of being decentralized, distributed, immutable, shared, and impossible to change. Blockchain can be viewed as a library that saves transaction records and organizes them into blocks based on the time they occurred. An encryption hash is a key feature that distinguishes each block. Every block contains the

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hash value of the block that came before it. As a result, a link is formed between the individual blocks, leading to the construction of a blockchain. A thorough knowledge of how a Blockchain network works is only achievable by delving deeply into its working components. Each node in a peer-to-peer network has a complete record of all the events that have occurred on that node. Because each node has its own wallet, transactions are possible across all nodes. A cryptographic technique is used to communicate amongst network users. This technique makes use of a pair of secret and public keys. Individuals can only use their own private keys to confirm their own transactions, however all network nodes can access a person's public key. To create a digital signature, the sender must sign a message that includes a transaction with their private key. This digital signature is created by combining the signed message and the sender's public key. The transaction is added to the Blockchain network, and miners verify its authenticity. Miners are the high-performance nodes in the Blockchain network. Miners utilize a consensus process known as "Proof of Work" to ensure that transactions cannot be modified or undone. To create a legitimate block, miners must compete against one another, with the winner receiving a prize.



Fig. 2 Making Use of Blockchain Technology Before a transaction's block can be declared legitimate, every miner on the network must agree

that it is real. If the majority of miners agree that the block is correct, it gets added to the longest Blockchain.

Literature Survey

This section provides an overview of various programs attempting to secure medical records, as well as the challenges they confront and potential solutions.

How blockchain technology can be used to limit who has access to eHealth data. The article "Towards utilizing Blockchain technology for managing e-Health data access" discusses the benefits and drawbacks of Blockchain technology for safely integrating health information. It also provides an expandable solution, which increases efficiency. In addition, a new framework has been developed to address the issues associated with applications. Using smart contracts, health hospitals and doctors are viewed as related entities within the eHealth Blockchain in this paradigm. An off-chain database is also employed to support this concept. A data gateway allows patients to connect to the blockchain and medical equipment. This study also discusses how Blockchain technology, crucial tools, models, and protocols may be leveraged to create fully functional systems that can lead to significant advances in future applications.

"Decentralized e-Health Architecture for Boosting Healthcare Analytics" was written by those who conducted medical data analysis and security research. Furthermore, they have attempted to develop an intervention that will improve the overall standard of medical care. Researchers created a Blockchain-based solution for state-level healthcare using the Exonum framework. This architecture is composed of nodes that are all linked to one another and use public key authentication to establish peer-to-peer connections. The authors also stated that Blockchain technology will be utilized to properly manage massive amounts of healthcare data while respecting patients' privacy. Another advantage of blockchain technology is that it has the potential to create a market for data-driven products. This would enable users to participate in medical analytics and maybe be compensated for sharing their data with medical research and care

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organizations. c) Can blockchain technology assist poor countries in resolving security and interoperability issues with their electronic medical record (EMR) systems? Using Blockchain technology in electronic medical records (EMR) ensures that data is always available and can be retrieved immediately, according to the study "Is this the solution to EMR interoperability and security issues in developing countries?" The authors conducted a study in Kenya that examined an instance of electronic medical records (EMR). The purpose of the study was to look at the current system for preserving health information and emphasize the importance of using Blockchain technology to make the system more safe and interoperable. Patients have complete control over their data thanks to blockchain technology, which allows them to choose who can see it and how it is shared. It's also worth noting that Blockchain technology, through the use of cryptography, makes it easier for people to communicate with one another inside a network. This means that confidence does not need to be built up ahead of time [6]. When patients share their data with other persons or organizations, information encryption is a useful way to secure their privacy. d) The Application of Blockchain Technology in Healthcare: The authors of the paper "Introducing Blockchain for Healthcare" discussed the various topologies of Blockchain, the problems that are currently occurring in the field of Blockchain, and potential solutions to these problems. When Blockchain technology is used to set up smart contracts between healthcare providers[7] and provide regulated access to certain data or patient records, concerns have been raised concerning the identity of data users and their authorization status. Another security concern that comes up while discussing blockchain technology is the Sybil attack. This attack can be avoided by requiring each miner node to successfully solve a mathematical challenge before adding a new block to the blockchain [7]. As a result of these issues, the author proposes that scientists develop a new Blockchain system architecture that does not rely on a current cryptographic approach. Concerns have also been expressed about the

disclosure of private and sensitive information.

3.MEDICALDATAMANAGEMENT ON BLOCKCHAIN

In today's healthcare system, health information on individuals is stored on computers.

Currently, healthcare organizations incorporate information about patients, diagnostic data, and doctor prescriptions. Because the system is monitored, there are concerns that patient data could be leaked or misused. These concerns are exacerbated by the fact that users in this system have little control over their personal data. Adding to the difficulties of maintaining precise and full data is the fact that altering data in the system takes a long time and is difficult to grasp. We advocate converting a centralized system to a decentralized system utilizing Blockchain technology. This will assist with these issues. Blockchain technology has the potential to be used in healthcare, but it is critical to thoroughly comprehend the amount of data involved and where it comes from. Healthcare organizations generate a large amount of sensitive and critical medical data throughout the whole medical treatment process, including consultations. surgeries. Sensitive diagnosis, and health information includes reports from diagnostic imaging such as X-rays, MRI scans, and ultrasounds, as well as medical treatments such as angiography, radiography, and endoscopy. Specific ailments such as cancer, HIV, and mental problems are also listed in this category.

To make data more credible, it is critical to improve its value before adding it to the blockchain. Unorganized data in medical records can lead to errors and delays in providing healthcare services. As a result, it is critical that patients' medical records are clear, thorough, and well-organized. Spreading digital health records over the Blockchain network is an excellent solution to address the issue of data centralizedness.

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Fig. 3. The method of keeping track of medical records

- > Patients' medical data could be saved on the Blockchain network if their public keys are used. The inclusion of the patients' unique names and public keys in transactions involving their medical data ensures the security of the information. When the different identification numbers match, businesses in the healthcare area can utilize smart contracts to access a patient's non-identifiable data. Patients can share their public key to health groups if they believe it is necessary. But keep in mind that the data associated with the public key cannot be linked to a single person without their private key [12]. Smart contracts are critical for making data transmission and reception safe for users.
- There is no information in the person's text. "Smart contracts" are agreements between two parties that are written in unambiguous computer code and do not require the involvement of a third party. The technology facilitates the negotiation and execution of digital contracts by validating and supporting them.
- The user's text lacks academic language and structure. The proposed structure is used in this study as a healthcare agreement with two nodes, one for each hospital administrator and one for each lab administrator. The "record" structure contains a wealth of information on the patient, including their address, unique ID, test name, date, hospital name, price, isvalue, and signature count.

Invoking the transaction:

The public constructor was utilized when the Dapp was originally introduced. The hospital

administrator is the only individual who may initiate Blockchain network activity. The hospital administrator then selects the labadmin and assigns them a unique address.

New Record Creation:

The newRecord function was designed to allow more information to be added to an existing record. This is accomplished by assigning numbers to the arguments that accompany them. The "Records" group is used to keep previously produced patient records.

Validation:

A method called "signrecord" was invented to ensure that records are genuine. The process checks the signature count to see if there is a new record in the current record group. The hospital executive will sign off on the deal as soon as the new record is found. If the new record cannot be found, the number of signatures will be set to 1. The government will not accept the agreement. A record must have two signatures in order to be issued.



Fig. 4. The smart contract's logic flow model.

4.CONCLUSION AND FUTURE WORK

In keeping with the adage "Health is Wealth," "Health Records are Wealth" can now be added to the list of current assets. As a result, safeguarding our medical data has become even more critical. Patient-driven interoperability is becoming more popular around the world. This is when patients authorize rapid access to their medical data. According to this theoretical framework, the patient owns all of their medical data and has the right to choose whether or not to disclose it. Unlike traditional data management methods,

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blockchain decentralizes the entire process, making it easier to cope with the issues that arise while shifting from an institution-centered to a patient-centered paradigm. In a study conducted by IBM's Institute for Business Value Blockchain, 16% of 200 health leaders were asked about their ambitions to adopt Blockchain technology for business. As previously said, blockchain technology not only allows users to view data in real time, keep data secret, process vast amounts of data efficiently, and verify and authorize data.

Smart contracts are pieces of code that run autonomously when both parties agree to follow a predefined set of rules. They are used in our concept. From this perspective, the patient and the medical administration are two distinct entities. To use the smart contract, make records, and validate them, there are three stages that can be taken. According to the findings of this study, employing Blockchain technology could be a smart approach to keep track of medical data more efficiently. Blockchain technology is used for more than simply health record management. It is also utilized in banking, electronic voting, transportation, supply chain management, and other industries. More research and study could accelerate potentially the application and implementation of blockchain technology in many domains, improving people's overall health and happiness.

REFERENCES

- Rifi, Nabil, Elie Rachkidi, Nazim Agoulmine,andNada Chendeb Taher. "Towards using blockchaintechnology for eHealth data access man- agement." In 2017 Fourth International Conference on Advances in Biomedical Engineering (ICABME), pp. 1-4. IEEE, 2017.
- Kotsiuba, Igor, Artem Velvkzhanin, Yury Yanovich, Iuna Skarga Ban- durova, Yuriy Dyachenko, and Viacheslav Zhygulin. "Decentralized e- Health Architecture for Boosting Healthcare Analytics." In 2018 Second World Conference on Smart Trends in Systems, Security and Sustainabil- ity (WorldS4), pp. 113-118. IEEE, 2018.
- 3. Mikula, Tomas, and Rune Hylsberg Jacobsen. "Identity and Access Management with

Blockchain in Electronic Healthcare Records." In 2018 21st Euromicro Conference on Digital System Design (DSD), pp. 699- 706. IEEE, 2018.

- 4. Soumyalatha Naveen, Manjunath R Kounte, Machine Learning based Fog Computing as an Enabler of IoT, International Conference on New Trends in Engineering and Technology (ICNTET), Tiruvalur, Tamil Nadu, India, 7-8 Sep 2018
- Kamau, Gabriel, Caroline Boore, Elizaphan Maina, and Stephen Njenga. "Blockchain Technology: Is this the Solution to EMR Interoperability and Security Issues in Developing Countries?." In 2018 IST-Africa Week Conference (IST-Africa), pp. Page-1. IEEE, 2018.
- 6. Alhadhrami, Zainab, Salma Alghfeli, Mariam Alghfeli, Juhar Ahmed Abedlla, and Khaled Shuaib. "Introducing blockchains for healthcare." In 2017 International Conference on Electrical and Computing Technologies and Applications (ICECTA), pp. 1-4. IEEE, 2017
- Chintarlapallireddy Yaswanth Simha, Harshini V M, L V S Raghuvamsi, Manjunath R Kounte, "Enabling Technologies for Internet of Things Its Security issues", Second International Conference on Intelligent Computing and Control Systems (ICICCS 2018), Madurai, India, 14-15 June 2018, pp 1849-1852
- Wehbe, Youssef, Mohamed Al Zaabi, and Davor Svetinovic. "Blockchain AI Framework for Healthcare Records Management: Constrained Goal Model." In 2018 26th Telecommunications Forum (TELFOR), pp. 420-425. IEEE, 2018.
- 9. Novikov, Sergey P., Oleg D. Kazakov, Natalya A. Kulagina, and Natalya Yu Azarenko. "Blockchain and Smart Contracts in a Decentralized Health Infrastructure." In 2018 IEEE International Conference" Quality Transport and Management, Information Security, Information Technologies"(ITQMIS), pp. 697-703. IEEE, 2018.
- Kaushik, Akanksha, Archana Choudhary, Chinmay Ektare, Deepti Thomas, and Syed Akram. "BlockchainLiterature survey." In

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2017 2nd IEEE International Conference on Recent Trends in Electronics, Infor- mation Communication Technology (RTEICT), pp. 2145-2148. IEEE, 2017.