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Digital Health using Blockchain

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ABSTRACT: The significance of maintaining accurate and confidential medical records cannot be overstated. These records contain crucial information and are commonly exchanged among hospitals, pharmacies, and private clinics. It is crucial that the information remains up-to-date and accessible only to authorized individuals to ensure patient privacy and safety. Centralized storage of medical records in traditional healthcare systems is vulnerable to cyber-attacks and data breaches. Additionally, patients often lack access and control over their medical records, impeding data portability and interoperability across healthcare providers. Manual processes for sharing patient information are time-consuming and prone to errors. Blockchain technology, particularly blockchain-based smart contract systems, holds promise for managing patient medical records in healthcare. A personalized digital health record based on blockchain offers secure and decentralized storage, granting patients control over data access and enabling efficient data sharing among healthcare providers.

KEYWORDS: Blockchain Technology, Smart contracts, decentralized storage, Health Information Exchange, Data Control.

I. INTRODUCTION

Private health information, electronic medical records, and electronic health records have become valuable assets with the potential to impact people's lives worldwide. The World Health Organization recognizes that sharing personal health information extends beyond its primary medical use. However, the fragmentation and isolation of this data in hospitals and healthcare networks, driven by industry and government regulations, present challenges in fully utilizing its potential. The true value of this asset is unlocked when the data is available, accessible, and complete at the point of care when needed.

Digital health information exchanges have emerged as a solution, enabling the digital transfer of patient medical records among caregivers and institutions. This has addressed issues such as redundant testing, improved care coordination, reduced administrative costs, and enhanced patient quality of life.

Yet, certain challenges persist despite ongoing efforts. Interoperability, data security, privacy, and maintaining control over data after transmission remain key concerns. Current methods offer limited control over how requested data is used or processed, with legal and regulatory measures addressing wrong or unethical use.

A blockchain-supported digital health information exchange offers a potential solution, incorporating mechanisms to monitor and enforce acceptable use policies for patient data. During registration, patients establish policies that dictate permissible actions on their personal health information. These policies are stored in the system and consulted alongside smart contracts to determine data sharing permissions. Processing nodes, smart contracts, and security monitors within participating health institutions collaborate to safeguard patient data from unauthorized access and unauthorized computations.

II. LITERATURE SURVEY

Over the years, many scholars and entrepreneurs have made many discussions and research on how to combine blockchain technology to improve and manage the current situation of the supply chain.

G. Perboli et al. [1] describes the standard methodology for developing and validating the overall Blockchain solution and designing a strategy for integrating it into Business Strategy. They also highlight how blockchain can tackle

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security challenges in IoT, such as identifying different devices and managing trust, information tracking, authentication and access control, and accountability in IoT-based applications.

Jamil et al. [3] proposed an application based on a user service framework that uses smart contracts and a distributed ledger as middleware. The proposed system is based on a permissioned blockchain that allows only valid participants to participate and enroll in the blockchain network, thus separating it from the other blockchain-based systems. The proposed smart contract-based application uses the transaction and executes several queries and updates the ledger state by appending the transaction blocks, and returns the updated result as a response to the application.

Q. Zhu et al. [5] focus on linking the product deletion decision-making process, which is a process of deleting a product and all its related information from the company's portfolio with Blockchain technology. The four main stages in the product deletion process have been proposed: recognition, analysis and revitalization, evaluation and decision-making, and implementation. Blockchain technology improves communication and collaboration among various entities in the supply chain and thus increases information efficiency, effectiveness and reduces conflicts.

Prachi Shrikant et al. [6] focuses on the importance of Blockchain technology to trace and detect counterfeit products in the supply chain. Every time the medicinal drug moves from one entity to another, the information stored in the blockchain makes it easy to track the drug, and thus the threat of counterfeit products is reduced. Blockchain technology helps solve the main issues, as each new transaction is time-stamped, enabling companies to track their products in the supply chain. Allowing stakeholders to take actions in case of any issues by identifying the exact location of the drug.

K. Toyoda et al. [7] proposed the need to develop anti-counterfeit systems that will work when the RFID tag's information will be cloned in the post supply chain. Hence through the paper, they proposed The Possession of Products scheme. The counterfeits can be detected if any entity is unable to prove the possession of the particular product. They have suggested blockchain, as Bitcoin allows users to prove their ownership without the need for any authentication and centralized authority.

Huang et al. [8] narrate the importance of Drugledger, a fully scenario-oriented blockchain system for drug traceability and regulation. Drugledger uses the UTXO-based transaction model combined with the supply chain to construct the entire workflow that includes drug packaging, repackaging, unpackaging and drug transaction cancellation, the arrival and exit of the drug supply chain, and so on. Thus, the Drugledger manages to separate the drug traceability service from data modification, ensuring data authenticity and privacy.

III. METHODOLOGY

Cryptography is a technique employed to safeguard information and communication by utilizing codes, ensuring that only the intended recipient can comprehend and process it, thus preventing unauthorized access. The term "crypt" signifies "hide," and "graph" refers to "write." In cryptography, mathematical concepts and algorithms are employed to transform messages into intricate and challenging-to-decode formats. These algorithms play a crucial role in encryption key generation, digital signatures, authentication, and data privacy protection, including secure internet browsing and confidential transactions like credit and debit card transactions.

Blockchain, on the other hand, is a technology that encompasses digital currencies such as Bitcoin, Litecoin, Ethereum, and more. It enables the distribution and decentralization of digital information while maintaining its integrity and preventing manipulation. Each piece of data within a blockchain can have multiple owners, yet only one owner at a time. It functions by storing data in blocks, which are records of new transactions. When a block is completed, it becomes part of the chain, creating an immutable and transparent ledger.

A smart contract refers to code written on a blockchain that enforces the terms and conditions of an off-chain agreement or contract. It automates operations that would typically require trust between the parties involved, thus eliminating the need for mutual trust.

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IV. RESULTS AND DISCUSSION

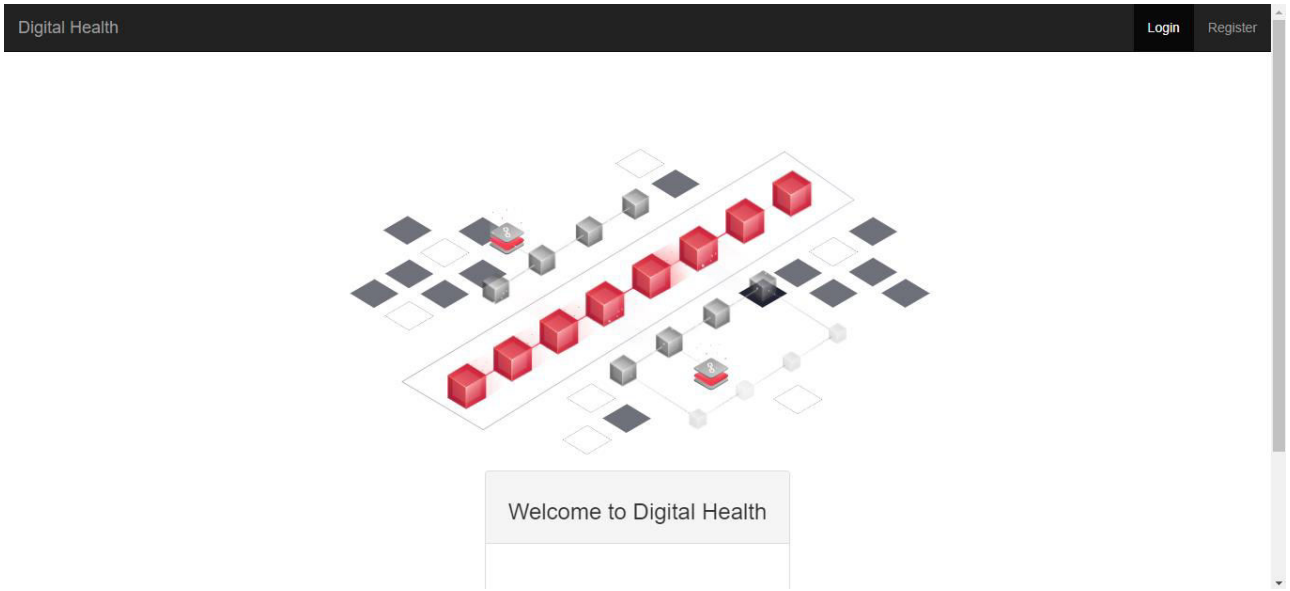

Fig.1. Login Page

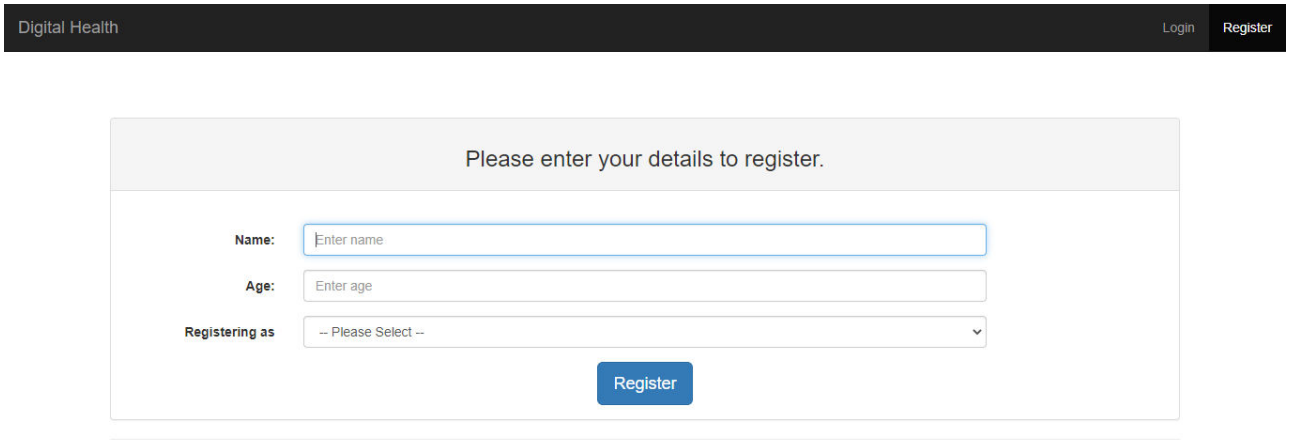

Fig. 2. Registration Page

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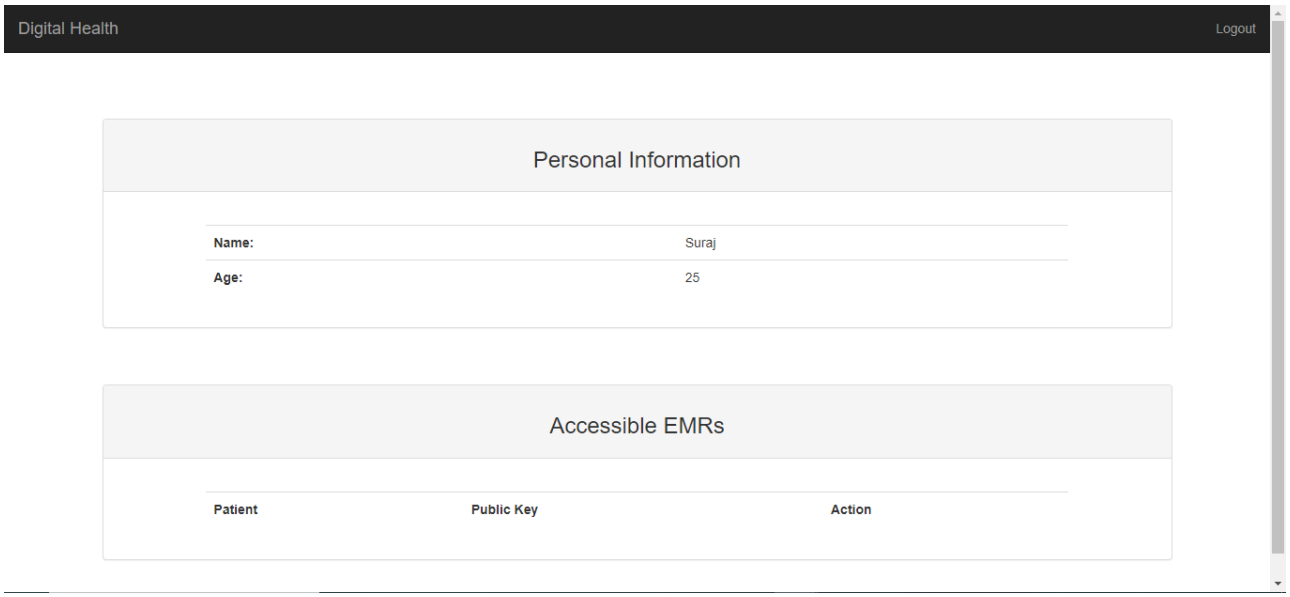

Fig. 3. Doctor's User Interface

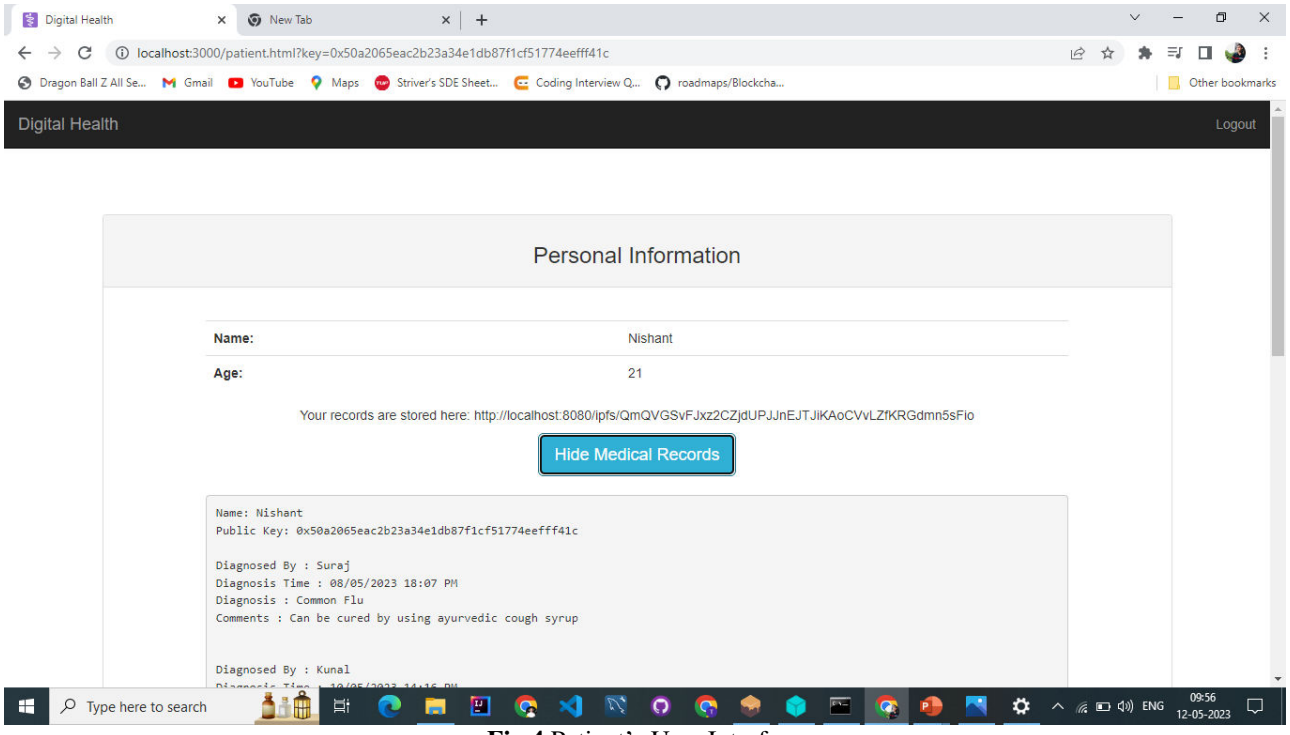

Fig 4. Patient's User Interface

V. CONCLUSION AND FUTURE WORK

In conclusion, the Digital Health system holds great promise for transforming healthcare by enhancing data security, interoperability, and patient control over their medical records. This system has the potential to improve healthcare outcomes, reduce costs, and streamline administrative processes.

As for future work, further research and development should focus on addressing challenges related to scalability, privacy, and regulatory compliance in implementing Digital Health systems. Additionally, exploring advanced encryption techniques, integrating artificial intelligence for data analysis, and expanding interoperability with other healthcare systems would be valuable areas to explore. Continued collaboration between healthcare professionals,

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technologists, and policymakers will be essential for realizing the full potential of blockchain in revolutionizing healthcare.

VI. ACKNOWLEDGEMENT

The authors mentioned have played a vital role in directly contributing their intellectual expertise to the development of the features. They have provided their explicit consent for the publication of their contributions, signifying their significant involvement in the project.

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