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Block Chain Based National Digital Health Record System

Ishwari Ikhe[1], Prathmesh Kadam[2], Rutuja Kadam[3], Komal Jadhav[4], Prof. Shital Wagh[5]

[1,2,3,4,5]Department of Computer Engineering
Matoshri College of Engineering & Research Centre, Eklhare, Nashik

Abstract:
Modern healthcare systems rely heavily on the management of patient health records. However, traditional methods of keeping medical records mostly on paper or in isolated hospital databases are frequently ineffective, unreliable, and challenging to access across a variety of healthcare providers. These limitations can lead to data loss, repeated medical tests, delayed diagnosis, and compromised patient care. To address these challenges, this paper proposes a Blockchain and QR Code–based National Digital Health Record System that ensures secure, reliable, and instant access to patient medical data.

Health records are stored in a decentralized and tamper-proof manner using the proposed system, which makes sure data integrity, transparency, and protection against unauthorized modifications. Each patient is assigned a unique QR code that serves as a digital key to their medical history. Authorized healthcare professionals can scan the QR code to instantly retrieve patient records, including prescriptions, lab results, and treatment history, thereby improving the efficiency and accuracy of medical services. The system is implemented using a web-based architecture with a user-friendly interface, backend processing, and secure data storage mechanisms. It provides role-based access for patients and doctors, enabling seamless data sharing while maintaining privacy and security. The proposed solution reduces manual paperwork, enhances healthcare coordination, and ensures faster decision-making. In general, the system provides a platform for modern digital healthcare management that is scalable, effective, and safe. Data Security, Decentralized Storage, Medical Data Management, Digital Healthcare, Secure Data Sharing, QR Code, Healthcare System, National Digital Health Record System, Blockchain Technology.

INTRODUCTION

Healthcare systems play a crucial role in ensuring the well-being of individuals and communities. The management of patient health records, which include medical history, diagnoses, prescriptions, and laboratory results, is one of the most crucial aspects of healthcare. These records are essential for accurate diagnosis and effective treatment. However, in many healthcare institutions, patient data is still stored in paper-based formats or in isolated digital systems that are not interconnected. This leads to several challenges such as loss of records, delays in accessing information, duplication of tests, and lack of coordination among healthcare providers.

Traditional health record management systems are often inefficient, time-consuming, and vulnerable to data breaches or tampering. When visiting various hospitals or doctors, patients frequently have trouble sharing their medical history, which can lead to inaccurate information and improper treatment. Moreover,

the absence of a unified and secure system reduces transparency and reliability in healthcare services. With the advancement of digital technologies, there is a growing need for a secure, efficient, and centralized system that can manage health records effectively. Emerging technologies such as blockchain and QR codes provide promising solutions to address these issues. Medical records are stored in a decentralized and immutable manner using blockchain technology, preventing unauthorized modifications and guaranteeing data integrity. At the same time, QR codes enable quick and easy access to patient data, allowing healthcare professionals to retrieve complete medical histories instantly.

This paper presents a National Digital Health Record System that integrates blockchain technology and QR codes to create a secure, transparent, and efficient healthcare platform. The system provides role-based access to users, enabling patients to manage their records and doctors to access and update medical information securely. The proposed system improves healthcare services' overall efficiency by eliminating paperwork, reducing errors, and enhancing data accessibility. This system's primary goal is to modernize health record management by providing a digital solution that is dependable, scalable, and easy to use. It also supports better medical treatment decision-making, improves coordination among healthcare providers, and ensures data security.

LITERATURE SURVEY

Due to the increasing demand for secure, effective, and accessible management of patient health records, the development of digital healthcare systems has received significant attention in recent years. Researchers have explored various technologies such as blockchain, Internet of Things (IoT), and cloud computing to improve data security, interoperability, and healthcare service delivery.

A patient care management system based on QR codes and blockchain technology was proposed by Manuel et al. (2022). Their research demonstrated that QR codes enable quick access to medical records and that blockchain ensures secure and tamper-proof storage of patient data. While this method reduces the need for physical documents and increases efficiency, it does not have the advanced features necessary for large-scale healthcare integration. An IoT-based framework for digital payment and electronic health record management was presented by Chauhan and Kavita in 2023. To digitally manage healthcare services, their system incorporates blockchain, QR codes, and Internet of Things (IoT) devices. Although it improves automation and reduces errors, the integration of multiple technologies makes the system more complicated. Nguyen et al. (2021) presented a cooperative architecture for smart healthcare systems using blockchain and edge computing. By handling data closer to the source, they focus on secure data sharing and faster processing. While the system improves performance and privacy, it requires advanced infrastructure and may not be easily adaptable in all healthcare environments.

HealthChain, a blockchain-based framework for patient-centered health record management, was proposed by Hylock and Zeng (2019). Patients are given complete control over their medical data through their system, which also ensures safe sharing among healthcare providers. While the framework enhances transparency and ownership of data, it does not address real-time accessibility through straightforward mechanisms like QR codes. A healthcare records management framework based on blockchain that improves security, privacy, and interoperability was discussed by Tahir et al. (2024). The significance of

decentralized systems for safeguarding sensitive medical data is highlighted by their research. However, the system lacks a user-friendly interface for quick data access and focuses primarily on data security. In their review of the application of blockchain technology in healthcare data management, Garg et al. (2022) emphasized the technology's role in maintaining the integrity of the data and preventing unauthorized access. Although their work provides a solid theoretical foundation, it lacks details on how to put their ideas into practice in actual healthcare systems. Ali et al. (2021) explored the integration of blockchain and machine learning for securing electronic health records. Their study shows improved data protection and intelligent analysis, but the system requires high computational resources and complex implementation.

Overall, research shows that IoT and machine learning improve healthcare systems' automation and decision-making, while blockchain technology significantly increases data transparency and security. However, many of the current solutions either only focus on security or do not provide a quick and easy way to access patient data. By combining QR code-based access and blockchain technology, the proposed National Digital Health Record System addresses these limitations and provides a secure, user-friendly, and effective platform for managing and retrieving patient health records across multiple healthcare providers.

METHODOLOGY

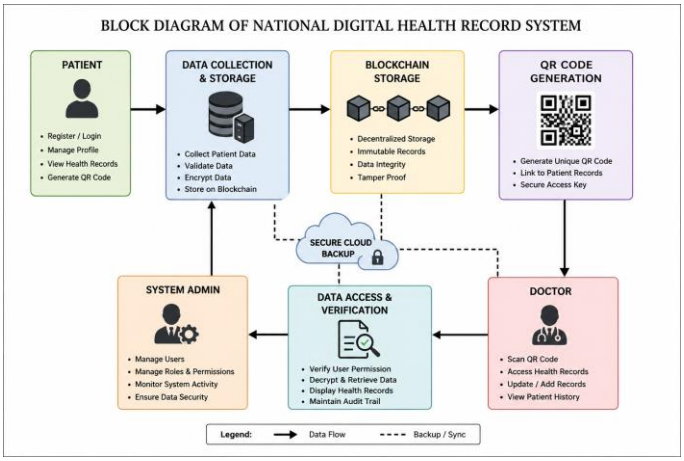
In order to create a healthcare platform that is both secure and effective, the proposed National Digital Health Record System employs a structured methodology that combines web technologies, blockchain, and QR code mechanisms. The overall workflow includes user interaction, data collection, secure storage, QR-based access, and data retrieval.

Initially, users access the system through a web-based interface developed using frontend technologies such as HTML, CSS, and JavaScript. Using authentication mechanisms, both patients and doctors must securely register and log in. Users have access to specific dashboards and permissions to carry out relevant system operations based on their roles. Once authenticated, patients can enter their personal and medical details, including basic information, medical history, allergies, and previous treatments. The backend system, which is built with a framework like Django and processes this data, handles request processing, validation, and database-to-user interface communication. The collected health data is securely stored using blockchain technology. Each record is converted into a block and linked to the previous block, forming a chain that ensures immutability and prevents unauthorized modification. This decentralized storage mechanism guarantees data integrity, transparency, and security of patient information.

The system creates a unique QR code for each patient after storing the data. This QR code acts as a digital key linked to the patient’s health records stored on the blockchain. The QR code can be printed or saved digitally for quick access during hospital stays. Doctors can scan the patient’s QR code using the system interface to instantly retrieve the complete medical history. This includes prescriptions, lab reports, diagnoses, and previous treatments. Doctors can add new diagnoses or treatment details to patients' records using this information, which is securely stored as new blocks in the blockchain. The system also ensures data access control by allowing only authorized users to view or modify health records. To

maintain transparency and traceability, the system records and validates every action. Lastly, the system is built to be scalable and can be used on cloud platforms, making it accessible to a variety of healthcare providers in a variety of locations. This methodology ensures secure data handling, efficient record management, quick access to patient information, and improved coordination between patients and healthcare professionals.

BLOCK DIAGRAM



OBJECTIVE

1. To develop a secure National Digital Health Record System that stores patient medical data using blockchain technology to prevent data tampering and ensure integrity.
2. To provide an efficient platform for patients and healthcare professionals to access and manage health records in a centralized and user-friendly manner.
3. To implement QR code–based access for instant retrieval of patient medical history, reducing time and improving healthcare service efficiency.
4. To ensure data privacy and controlled access by allowing only authorized users to view or update health records.
5. To improve overall healthcare quality by reducing paperwork, minimizing errors, and enabling faster and more accurate medical decision-making.

PROBLEM DEFINATIONS

It is difficult to access, share, and manage patient records in the current healthcare systems because they are stored on paper or in separate databases. This results in the loss of data, repeated tests, treatment delays, and poor hospital coordination. Therefore, in order to efficiently store and access health records while maintaining data integrity and privacy, a centralized, secure digital system is required..

FUCTIONAL REQUIREMENTS

1. The system shall allow patients and doctors to register and log in securely.
2. The system shall enable doctors to add, update, and manage patient health records such as prescriptions, reports, and diagnosis.

3. The system shall generate a unique QR code for each patient to link their health records.
4. The system shall allow doctors to scan QR codes and instantly retrieve patient medical history.
5. The system shall ensure that only authorized users can access or modify health records.

NON FUCTIONAL REQUIREMENTS

1. **Performance:** The system should provide fast data access and quick response during QR code scanning and retrieval.
2. **Security:** All health records must be securely stored using blockchain to prevent unauthorized access or tampering.
3. **Usability:** The system should have a simple and user-friendly interface for both patients and doctors.
4. **Reliability:** The system should ensure continuous availability and prevent data loss or corruption.
5. **Scalability:** The system should support a large number of users and medical records without affecting performance.

IMPLEMENTAION

Fig: Home Page

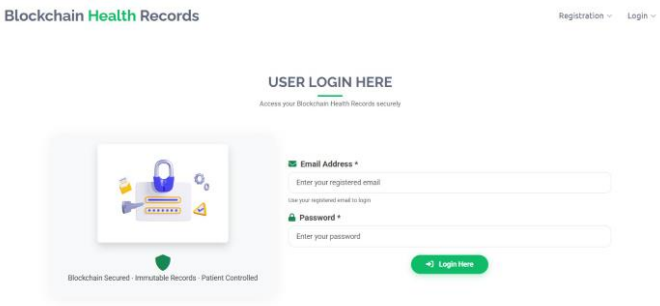


Fig: Login

CONCLUSION

Utilizing blockchain and QR code technology, the proposed National Digital Health Record System offers a secure and effective method for managing medical data about patients. It reduces paperwork in healthcare systems and ensures quick access to data. The system improves coordination between patients and doctors while enabling faster and more accurate treatment. In general, it provides a modern and dependable digital healthcare management solution..

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