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# **Secure Electronic Health Record Management (EHR)**

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**ABSTRACT:** This project introduces a decentralized application for Secure Electronic Health Record (EHR) management, addressing the security and interoperability challenges of traditional systems. Leveraging the Ethereum blockchain, the system provides an immutable and transparent ledger for all data transactions and access permissions. Patient medical records are encrypted and stored off-chain on the Inter Planetary File System (IPFS), with only their cryptographic hashes recorded on-chain to ensure data integrity and efficiency. Smart contracts govern the core logic, automating patient-defined access control rules for doctors and diagnostic centers. Users interact with the platform through MetaMask, which facilitates secure cryptographic signing of transactions. This model places patients at the center, granting them full sovereignty to manage access to their health information. Doctors can view permissioned records and generate consultancy reports, while diagnostic centers can securely upload new medical data.

## **I. INTRODUCTION**

The rapid digitalization of healthcare systems has led to the widespread use of Electronic Health Records (EHRs). However, traditional EHR systems suffer from several critical issues such as data breaches, lack of interoperability, centralized control, and limited patient involvement. Sensitive medical data stored in centralized databases is highly vulnerable to cyberattacks, unauthorized access, and data manipulation, raising serious concerns about privacy and security.

Moreover, patients have minimal control over their own health records, as access and management are primarily handled by healthcare institutions. This lack of transparency reduces trust and makes it difficult for patients to share their data securely across different providers.

With the advancement of blockchain technology, there is an opportunity to transform the healthcare data management system. Blockchain provides a decentralized, tamper-proof, and transparent platform that ensures data integrity and secure access control. By integrating blockchain with off-chain storage solutions like IPFS, it is possible to efficiently manage large medical data while maintaining security and privacy.

This project is motivated by the need to develop a secure, patient-centric, and decentralized EHR system that enhances data protection, ensures interoperability, and empowers patients with full control over their medical information

## **II. EXISTING SYSTEM**

The traditional Electronic Health Record (EHR) systems are primarily centralized, where patient data is stored and managed by hospitals, clinics, or third-party service providers. These systems rely on a single authority to control access, storage, and sharing of medical records. While they have improved the digitization of healthcare, they still face several significant challenges.

In existing systems, data is stored in centralized databases, making them highly vulnerable to cyberattacks, data breaches, and single points of failure. Unauthorized access and data tampering are major concerns due to weak access control mechanisms and lack of transparency in data handling.

Another major limitation is the lack of interoperability between different healthcare providers. Medical records are often stored in incompatible formats across various systems, making it difficult to share patient information efficiently. This leads to delays in diagnosis, repeated tests, and increased healthcare costs.

Additionally, patients have very limited control over their own medical data. Healthcare providers act as the primary custodians of records, and patients must rely on them to access or share their information. This reduces patient autonomy and raises concerns about privacy and data ownership.

Overall, while existing EHR systems have improved record management compared to paper-based systems, they still struggle with issues related to security, transparency, interoperability, and patient-centric control.

### **III. PROPOSED SYSTEM**

The proposed system introduces a decentralized and secure Electronic Health Record (EHR) management platform using blockchain technology. Unlike traditional centralized systems, this solution leverages the Ethereum blockchain to create a transparent, tamper-proof, and immutable ledger for managing healthcare data access and transactions.

In this system, patient medical records are not stored directly on the blockchain due to size and efficiency constraints. Instead, they are securely encrypted and stored off-chain using the InterPlanetary File System (IPFS). The blockchain stores only the cryptographic hash of each record, ensuring data integrity while maintaining scalability and performance.

Smart contracts play a key role in the system by automating access control mechanisms. Patients have full authority to grant or revoke access to their medical records for doctors and diagnostic centers. This ensures a patient-centric model where individuals maintain complete ownership and control over their data.

Users interact with the system through MetaMask, which provides secure authentication and enables cryptographic signing of transactions. Doctors can access patient records only when permission is granted and can generate consultation reports, while diagnostic centers can upload new medical data securely to the system.

Overall, the proposed system enhances security, ensures transparency, improves interoperability, and empowers patients by giving them full control over their healthcare data in a decentralized environment

### **IV. METHODOLOGY**

#### **4.1 User Authentication**

Users such as patients, doctors, and diagnostic centers authenticate using MetaMask. This ensures secure login through cryptographic signatures instead of traditional passwords, providing strong identity verification.

#### **4.2 Data Collection and Encryption**

Patients upload medical records like reports and prescriptions. Before storage, all data is encrypted to maintain privacy and protect sensitive healthcare information.

#### **4.3 Decentralized Storage (IPFS)**

Encrypted medical records are stored in the InterPlanetary File System (IPFS). This ensures decentralized, secure, and efficient storage of large healthcare data.

#### **4.4 Blockchain Integration**

A unique cryptographic hash of each record is generated and stored on the Ethereum blockchain using smart contracts. This ensures data integrity and prevents tampering.

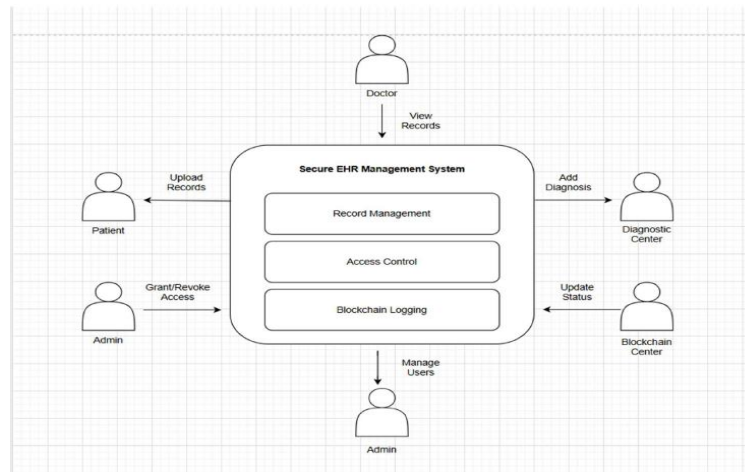
#### **4.5 Access Control and Data Sharing**

Patients control access to their records by granting or revoking permissions. Doctors and diagnostic centers can access data only after approval, ensuring secure and transparent data sharing.

### **V. SYSTEM ARCHITECTURE**

The proposed system follows a decentralized architecture using Ethereum blockchain and IPFS. Users such as patients, doctors, and diagnostic centers interact through a web interface with MetaMask for secure authentication. Medical data

is encrypted and stored off-chain in IPFS, while its hash is recorded on the blockchain to ensure integrity. Smart contracts manage access control, allowing patients to grant or revoke permissions. This architecture ensures security, transparency, and efficient management of health records.



The diagram represents the overall working of the **Secure EHR Management System**, highlighting the interaction between different users and system modules.

The system consists of four main actors: **Patient, Doctor, Diagnostic Center, and Admin**. The Patient uploads medical records into the system, which are managed under the **Record Management** module. These records are securely stored and can be accessed only with proper authorization.

The **Doctor** can view patient records after receiving permission, while the **Diagnostic Center** can add diagnosis reports and update medical data. The **Admin** plays a crucial role in managing users and controlling access by granting or revoking permissions through the **Access Control** module.

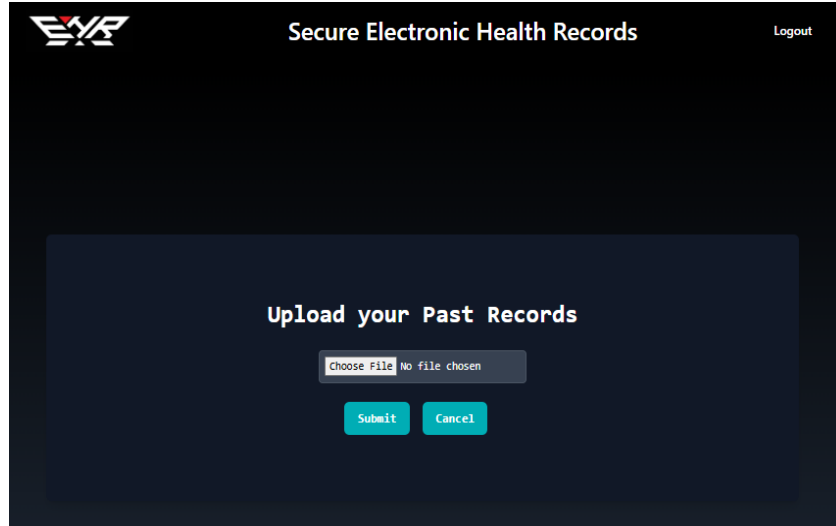
All activities within the system, such as record uploads, access requests, and updates, are tracked under the **Blockchain Logging** module to ensure transparency, security, and immutability.

Overall, the diagram illustrates a secure, decentralized workflow where data is efficiently managed, access is controlled, and all operations are transparently recorded.

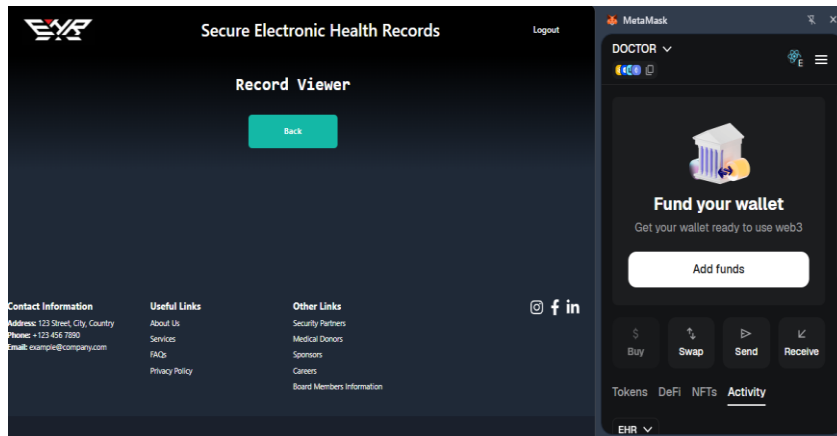
## VI. RESULTS AND OUTPUT



Doctor's dashboard



Upload EHR [From Patient's side]



View Records



Retrieval of EHR Record

## VII. CONCLUSION

The proposed system successfully demonstrates the integration of modern technologies to improve the efficiency, security, and reliability of managing Electronic Health Records (EHR). By incorporating blockchain technology, the system ensures data integrity, transparency, and tamper-proof storage, which are critical in the healthcare domain.

The modular design—including authentication, doctor, patient, and record management modules—provides a scalable and user-friendly solution. Each component works cohesively to streamline healthcare processes such as patient data access, prescription management, and secure record sharing.

Overall, the system addresses key challenges in traditional healthcare systems, such as data breaches, lack of interoperability, and inefficient record handling. With further enhancements and real-world deployment, it has the potential to significantly transform digital healthcare services and improve patient care outcomes.

## VIII. FUTURE SCOPE

The proposed Secure EHR Management System can be further enhanced by integrating advanced technologies and expanding its capabilities. In the future, the system can incorporate **Artificial Intelligence (AI)** to provide predictive healthcare insights, such as disease prediction and personalized treatment recommendations based on patient history.

The platform can also be extended to support **interoperability across multiple hospitals and healthcare organizations**, enabling seamless data sharing on a larger scale. Integration with **IoT-based medical devices** can allow real-time health monitoring and automatic updating of patient records. Additionally, implementing **multi-chain or hybrid blockchain solutions** can improve scalability and reduce transaction costs. Enhanced **data analytics and visualization tools** can help doctors make better clinical decisions.

The system can also include **mobile application support** for easier access and improved user experience. Strengthening compliance with healthcare regulations and introducing **biometric authentication** can further enhance security and reliability. Overall, these improvements can make the system more intelligent, scalable, and widely adaptable in real-world healthcare environments.

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