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Secure Health Hub with Blockchain Enhanced (Blockchain-Enhanced Hospital Management)

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***Abstract:** This article aims to address the critical need for asecured and patient-centric blockchain-based healthcare system. The research focuses on developing a hospital management system utilizing patient and doctor informationon the Ethereum platform using a systematic approach. Smart contracts are used in Solidity to manage data. Local testing on Hardhat is conducted, and once successful the system is to be deployed on Ethereum. Security audits are performedto ensure robustness.*
***Keywords:** Blockchain, Ethereum, Solidity, EHR (ElectronicHealth Records), Centralized*

I. INTRODUCTION

The introduction of a blockchain-based hospital management system signifies a transformative approach to healthcare administration. It leverages blockchain's security and decentralization to optimize data management, streamline operations, and prioritize patient confidentiality. This innovation promises to revolutionize healthcare by ensuring trust, transparency, and efficiency in patient care and record management.

II. SYSTEM ARCHITECTURE

1) Frontend: Developed using React.js to provide a dynamic user interface that handles user interactions for logging in, booking appointments, and interacting withdoctors.
2) Backend : Uses MongoDB to store doctor data. Manages patient appointments and interactions Communicates with the Ethereum blockchain for storing medical records securely.
3) Blockchain Integration: Utilizes the Ethereum blockchain for storing medical health records securely. Uses smart contracts written in Solidity tomanage the storage and retrieval of medical records.Integrates with Metamask wallet for adding patient details to the blockchain.
4) Authentication and Authorization: Implementsauthentication mechanisms for patients, doctors,and admins. Ensures that only authorized users canaccess specific features and data.
5) Communication Services: Utilizes Socket.IO forreal-time communication between patients and doctors through chat and video conferencing.
6) Admin Panel: Allows admins to add/remove doctors and patients.
7) Data Security: Ensures the security and integrityof patient data using blockchain technology. Implements encryption and secure communication protocols to protect sensitive information.

This architecture provides a secure and efficientsystem for managing medical health records using blockchain technology, ensuring data integrity and privacy for patients and doctors.

III. PLAN OF ACTION

The work plan of the research project includes interaction between various components. The main components are the User, Doctor, and Admin which are illustrated below:

A. User
1) Has the option for registering or Sign infirst.
2) Login is done with username and password.
3) When login is successful, the preferreddepartment is to be selected.
4) All available doctors are displayed.
5) User can select the preferred doctor.
6) User details (Height, weight, and address) are entered along with payment.

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7) When payment is successful, an appointmentwith the doctor is confirmed.
8) The user is sent the generated appointmentnumber and has to wait till the Doctorinitiates a conversation through ChatBot.
9) Email confirmation regarding the meetingis sent to the User.
10) Feedback is to be provided by The User.

B. Doctor
1) Doctor is supposed to Login.
2) Meetings are scheduled by the Doctor.
3) Patient is selected along with the countdown facility.
4) Meeting details page(with name, address and age) is displayed.
5) Accept/Reject with reason.
6) If accepted is "Yes", the Doctor confirms to meet the patient, and a scanned copy is sent to Admin for the record.
7) Otherwise, a suitable reason is given by the doctor suggesting to meet other doctors. The meeting details are sent to the suggested doctor by the assigned doctor.

C. Admin
1) Has access to User details.
2) Views the Booking status of the User.
3) Payment details of Bank, IFSC code, UPI payment, etc are maintained.
4) Sending of scanned documents and X-rays of the patient to the doctor
5) Monitors the number of clients attended by the Doctor.
6) Sees Accepted/Rejected.
7) Reads the reviews.

IV. METHODOLOGY

The methodology for developing a hospitalmanagement system utilizing patient and doctor information on the Ethereum platform involves a systematic approach.
First, the project scope and requirements are defined, followed by the design of systemarchitecture and user interfaces.
The development environment is set up with Node.js, Truffle, and Ganache or Hardhat for localblockchain testing. Smart contracts are crafted in Solidity to manage data, and the front end is implemented using JavaScript, HTML, and CSS. Local testing on Ganache or Hardhat is conducted,and once successful, the system is deployed on Ethereum. Security audits are performed to ensure robustness. Upon successful testing, the system isdeployed on the Ethereum, data privacy, and ongoing maintenance. User training and support are provided. This comprehensive methodology ensures a secure and efficient hospital management system on the Ethereum platform.

V. LITERATURE REVIEW

[1] The security and privacy of electronic healthcare records (EHRs) remain a critical issue for both healthcare services consumers and providers. Breaching a healthcare systemcauses the disclosure of sensitive health data.This data is usually saved into centralized databases, which creates vulnerabilities and gives rise to cyber attacks. This researchfocuses on enhancing the security andprivacy of EHRs by using blockchain technology. This paper proposes a new architecture that takes advantage of decentralized databases to avoid centralized storage issues. Besides, we have deployed a blockchain network built to save hashes of stored data and control access when retrieving it.
[2] In this paper, we propose MedRec: a novel, decentralized record management system to handle EMRs, using blockchain technology. Our system gives patients a comprehensive, immutable log and easy access to their medical information across providers and treatment sites. Leveraging unique blockchain properties, MedRec manages authentication, confidentiality, accountability and data sharing- crucial considerations when handling sensitive information. A modular design integrates with providers' existing, local data storage solutions, facilitating interoperability and making our system convenient and adaptable.
We incentivize medical stakeholders (researchers, public health authorities, etc.) to participate in the networkas blockchain "miners".

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This provides them with access to aggregate, anonymized data asmining rewards, in return for sustaining and securing the network via Proof of Work.

[3] Healthcare data, which is a personal assetof the patient, should be owned and managedby the patient rather than being dispersed among several healthcare systems, preventing data exchange and jeopardizing patient privacy. EHRs (electronic health records) assist individuals by allowing them to combine and manage their medical data. On the other hand, today's HER systems fallshort of providing patients with traceable, trustworthy, and secure ownership over theirmedical data, creating serious security risks. In this article, the authors propose PcBEHR (patient-controlled blockchain-enabled electronic health records) as a way for patients to have safe control over their data that is decentralized, immutable, transparent, traceable, and trustworthy. Decentralizedinterplanetary file storage (IPFS) is used in the suggested technique.

[4] In this paper, several solutions for improving current limitations in healthcare systems using blockchain technology are explored, including frameworks and tools tomeasure the performance of such systems, e.g., Hyperledger Fabric, Composer, Docker Container, Hyperledger Caliper, and the Wireshark capture engine. Further, this paperproposes an Access Control PolicyAlgorithm for improving data accessibility between healthcare providers, assisting in the simulation of environments to implement the Hyperledger-based electronic healthcarerecord (HER) sharing system that uses the concept of a chaincode.

[5] In this proposed system, we can build thisapplication using blockchain with stringent authentication. By considering this problem, we can propose the ADS application. SADSstands for stringent authentication and decentralized storage using blockchain. Stringent authentication is the process of providing high security protocols to the network using a cryptographic SHA-256 hashalgorithm. This application can be implemented using Ethereum blockchain technology. Decentralized storage is utilized for blockchain. Decentralized storage is where the breaking up of storage records takes place from one major server to multiple servers. This allows easy access to medical information and also helps to further research.

[6] In this work, we analyze the limitations of Ethereum-based blockchain with respect to electronic health record (HER) sharing through a third party. An Ethereum framework for decentralized and transactional privacy-preserving data sharing is proposed to address the needs of different stakeholders like patients, providers, and other thirdinvolved in the generation and access of patient data records. A secure approach for healthcare management systems using blockchain (SHEMB) obviates the need for atrusted third party for storing data. SHEMB uses a symmetric searchable encryption technique to speed up access to the records using the search query provided by the patient. The experimental results indicate the practical and secure nature of SHEMB.

[7] This paper proposes a permissionedblockchain-based system for HER datasharing and integration. Each hospital willprovide a blockchain node integrated with its own HER system to form the blockchain network. A web-based interface will be used for patients and doctors to initiate HER-sharing transactions. We take a hybrid datamanagement approach, where only management metadata will be stored on thechain. Actual HER data, on the other hand, will be encrypted and stored off-chain in Health Insurance Portability and Accountability Act–compliant cloud-based storage. The system uses public key infrastructure–based asymmetric encryptionand digital signatures to secure shared HER data.

VI. CONCLUSIONS

In conclusion, this study has presented acomprehensive exploration of Blockchain in the critical field of Healthcare using Ethreun technologies, showcasing its potential to significantly enhance its operation. By developinga robust solution for securely storing patient data on the Ethereum blockchain, data integrity andprivacy regarding patient details are maintained. The system ensures seamless sharing of medical information among healthcare providers for improved continuity of care. Beyond the technicalaspects, the paper underscores the broader impactof this technology, particularly in empoweringdoctors for consultation and streamlining the privacy and storage of patient details. As the fieldcontinues to evolve, this work contributes to the ongoing discourse on assistive technologies, providing a foundation for future research endeavors in the dynamic intersection of Blockchain and healthcare integration for improved accessibility and user experience.

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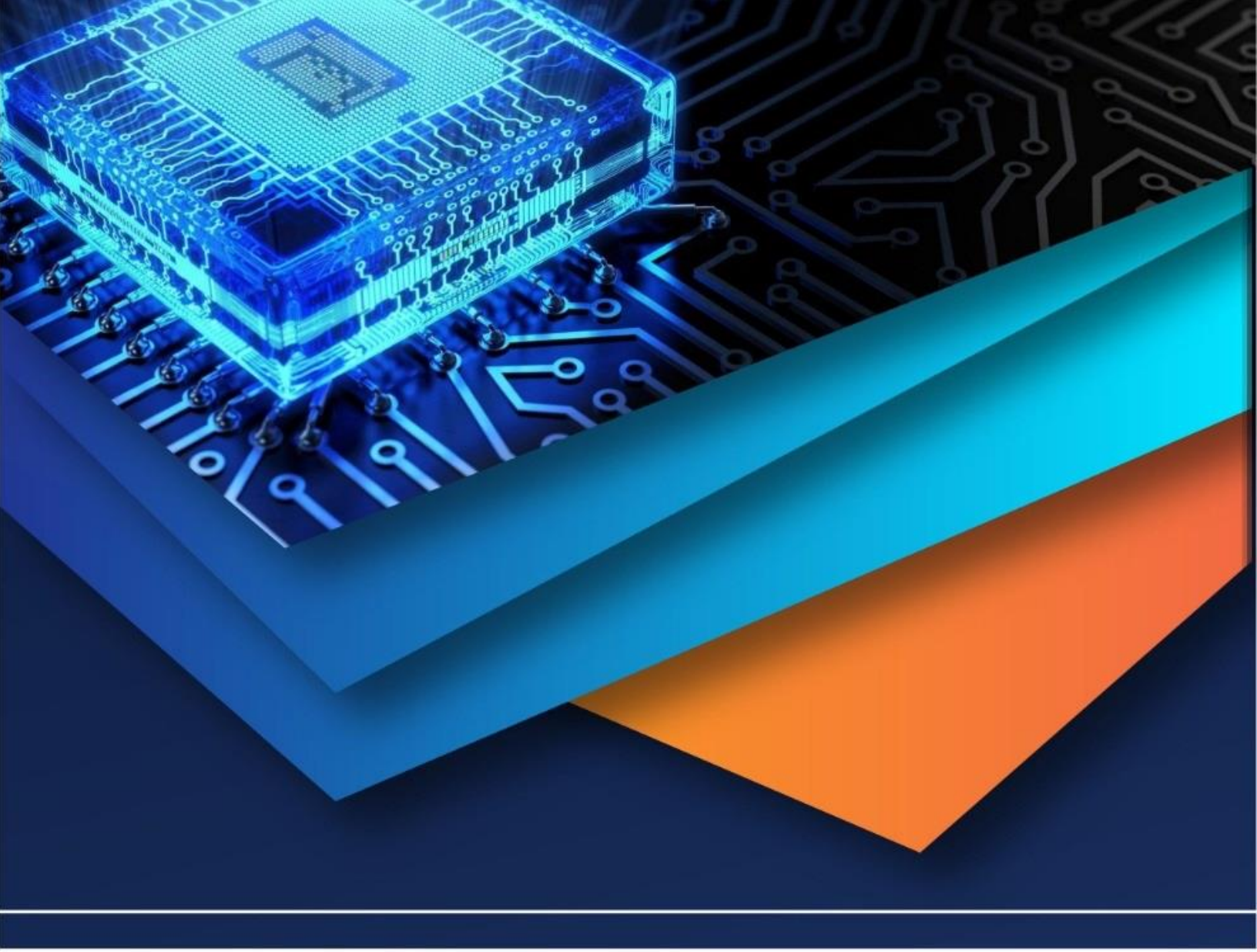
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C. Online Platforms:
[1] IEEE Xplore: IEEE Xplore is a digitallibrary for IEEE publications, includingjournals, conferences, and standards.
[2] Google Scholar: Google Scholar is a free search engine that indexes scholarly articles and academic papers across various disciplines.



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