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Blockchain Based MediChain System Connecting Pharma, Medicals and Patients Together

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Abstract: ***In today's world almost all hospital uses hardcopy for patient data store and for booking appointment. All patient data is available on paper and user need to manage that all over he goes. Consider 'A' patient got admitted in City Pune, all his data is stored on paper and what medicines he took. All the info about his health is stored there. After someday 'A' patient gone to another city far away without carrying any documents and there he got and health emergency and is not in condition of speaking and need urgently help. But due to lack of info available about patient doctor could not urgently take decisions. So, to reduce this risk our system is developed.***
Keywords: Dapp, Web3, Js.

I. INTRODUCTION

Smart Health Care Dapp is made to connect hospitals, Patient, Medicals and pharma company. As in today's world there are lot of misunderstandings between the doctors and patient and trust between them lacks. To develop trust between this entity smart health care Dapp will help.Whenever patient goes to the medicals to buy the medicines, he first think is the medicine provided by the medicals are good and not fake. Some medicals may keep fake medicines and expired medicines, these medicines may be provided to the patient. To avoid this, we can store all the medicines data on blockchain and track all process of medicines. And check if they came from trustworthy pharma company. There are basically 4 clients included into this project such as Hospital, Medical, Pharma, and Patients. Our Decentralized Storage will have the detailed medical history of each patient. It will be stored with the help of blockchain. The data will be available to hospital as well as patients in the decrypted format for the future reference.

So, the medicals are directly linked with hospitals or doctor, and not directly with the patients, whatever the prescription would be there will be sent by doctors to medicals without any intervention of patients, they will just need to collect their meds and essentials as prescribed directly from medical. This will prevent unethical purchase of medicine. So, in this way no patients will directly go and collect any medicines from medicals and there would be no threat of providing allergic or any other medicines which doesn't suit the Patient. Also, there will be no trust issues among the patients and medicals or pharma. Hospitals will play a very crucial role here, our decentralized system will have the hospital name, doctor's name, doctor's degree. In DAO the system automatically verifies the user. To participate in blockchain, user must be verified, hence this information will be very important.

We will keep record of medical's sales and analyze the most sold or most used medicines. This will help us to keep track of market's most valued medicines, so accordingly we it will be easy for us to make an order earlier based on its availability in the market. A decentralized autonomous organization are organizations built according to rules coded as computer programs, often transparent, and controlled by one central government. Controlled by members of the organizations rather than influenced.

Blockchain is a shared, unchangeable ledger that makes it easier to track assets and record transactions across business networks. Assets can be tangible (houses, cars, cash, land) and intangible (intellectual property, patents, copyrights, trademarks).

Blockchain is a form of public ledger, a series (or chain) of blocks in which transaction details are recorded after proper authentication and verification by designated network participants.

II. RELEVANCE OF WORK

The existing system have been able to recognize gestures with high latency as it uses only image processing. The following techniques are primarily used to identify sign gestures:

1) Glove-based method in which the signer has to wear a hardware glove, while the hand movements are getting captured.
2) Vision-based method further classified into static and dynamic recognition. While dynamic refers to the real-time, live capturing of the motions, statics deals with the identification of static gestures (2D pictures). In order to record motion, the camera is used in this. Although accurate, the glove-based approach looks a little awkward to employ in real-world situations. Although accurate, the glove-based approach looks a little awkward to employ in real-world situations.

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III.LITERATURE REVIEW

Every existing Virtual Assistant in today's date is found to be Voice Automated thereby making it unusable by Deaf-mutes and people with certain disabilities. This leads to the need of a system which can help people with speaking or listening disabilities to make use of such Virtual Personal Assistants [8]. Artificial Neural Network is used in majority cases where static recognition is performed as shown in [1], but there are few drawbacks related to the efficiency of recognizing distinctive features from images which can be improved by using Convolutional Neural Network. Convolutional Neural Network when compared to its predecessors, recognizes important distinctive features more efficiently and without any human supervision. Artificial Neural Network uses one-to-one mapping which increases the number of nodes required thereby degrading the efficiency whereas Convolutional Neural Network uses one-to-many, keeping the number of nodes low and greatly improving the efficiency [5]. Since many systems created with these goals tend to rely more on physical hardware—such as the Cyber Glove's design—manufacturing these devices becomes necessary, and users are forced to wear them in order to utilize virtual assistants. [11]. Many systems are designed in such a way that their application is limited to only certain Sign language or series of Hand gestures [9] On the other hand, the suggested system's architecture allows us to easily switch to any standard sign language by simply altering the dataset and refining the model accordingly.

IV.PROPOSED SYSTEM

We are building a healthcare data management system, combining the power of React.js, Solidity smart contracts, and Remix IDE. Our overarching goal is to establish a secure and transparent infrastructure for storing and managing patients' data, medicines information, and doctors' details on the blockchain.

Beginning with the technological foundation, the user interface will be crafted using React.js, known for its modular and efficient development. This web application will serve as the primary point of interaction, offering an intuitive experience for patients, doctors, and administrators. React's component-based architecture ensures a seamless and responsive user experience, crucial for effective engagement with the healthcare data stored on the blockchain.

The backbone of our system lies in the solidity of smart contracts. Developed within the Remix IDE, these contracts define the rules and logic governing data transactions on the blockchain. Each component—patients data, medicines data, and doctors' data—will be encapsulated within these self-executing contracts. They act as the guardians of data integrity, ensuring that the information stored is tamper-proof, transparent, and accessible only to those with the requisite permissions.

Delving into the system's architecture, the decentralized nature of blockchain will be harnessed for data storage. Every data entry becomes a transaction on the Ethereum blockchain, distributed across nodes. This ensures not only transparency and immutability but also heightened security through the elimination of a single point of failure.

Moving on to the specifics of data management, patient data will include critical health information such as medical history, prescriptions, and allergies. Each patient will be uniquely identified on the blockchain, and the data structure will facilitate secure and private storage. Medicines data will encompass details like composition, usage instructions, and potential side effects, ensuring traceability and quality control. For doctors, information such as credentials, specialization, and professional history will be securely stored, with access controls implemented to protect sensitive information.

Ensuring secure user interactions is paramount. Authentication will be a two-fold process—secure user authentication within the React.js application and decentralized authentication through Ethereum wallets. These wallets will be linked to user accounts, providing a secure gateway to the blockchain. Access control, enforced by smart contracts, will regulate the operations users can perform, with roles and permissions defined for patients, doctors, and administrators. This multi-layered approach guarantees the privacy and security of healthcare data. The integration of the blockchain with the web application will be facilitated by Web3.js. This library connects the React.js application with the Ethereum blockchain, enabling seamless communication between the front-end and the smart contracts. Users will interact with the blockchain using their Ethereum wallets, seamlessly executing transactions and accessing data securely. This integration not only enhances user experience but also streamlines the execution of functions on the blockchain. For robustness, smart contracts will undergo rigorous testing within the Remix IDE and other tools such as Truffle. Thorough testing ensures that vulnerabilities are identified and rectified before deployment. Once ready, smart contracts will be deployed on the Ethereum mainnet or a testnet, depending on project requirements. Consideration will be given to upgradeable contracts, allowing for future enhancements without disrupting the existing system.

Security measures are integral to our design. Privacy protocols, such as zk-SNARKs, may be implemented to enhance data confidentiality, ensuring sensitive patient information remains private even within a transparent blockchain. End-to-end encryption will be employed for data transmitted between the web application and the blockchain, adding an extra layer of security.

Scalability and performance optimization will be achieved through gas optimization. Smart contracts will be meticulously crafted to minimize gas consumption, ensuring cost-effective transactions on the Ethereum network. For large datasets, off-chain storage solutions may be explored to enhance scalability while maintaining on-chain data for immutability.

User training and regulatory compliance form critical aspects of our proposed work. Extensive documentation will be provided to users, administrators, and stakeholders, guiding them through system usage, blockchain interaction, and data security measures. Training sessions will be conducted to familiarize users with features, functionalities, and security measures. The system will adhere to relevant healthcare and data protection regulations, with features such as consent management aligning with privacy laws. An audit trail will be maintained, ensuring the system's transparency and accountability to regulatory bodies.

In conclusion, our proposed work envisions a comprehensive and secure healthcare data management system, poised to revolutionize the storage, accessibility, and security of patients' data, medicines data, and doctors' data. Through the integration of React.js, Solidity smart contracts, and Remix IDE, we aim to set new standards for healthcare data management, fostering a future where technological advancements contribute to improved patient care and data integrity.

V. OBJECTIVES

1) *Objective 1:* Provide user friendly UI for all the users to make functionality of project more effective and usable.
2) *Objective 2:* To create System which stores all the verified doctors and Hospitals to make them part of our network in blockchain DAO.
3) *Objective 3:* To approve the doctor implement admin panel where we can manage the Doctor, Medicals & Pharma companies.
4) *Objective 4:* To create system which stores all the patient data securely on the blockchain which is in the form of hash/encrypted form and can be only access using private key.
5) *Objective 5:* To create system for storing the overall process of the pharma company medicines making and adding all the data to blockchain
6) *Objective 6:* To create system which interconnects the pharma company and medicals for providing trustworthy medicines to the patient.

VI. METHODOLOGY

The methodology for developing a Blockchain-based MediChain system connecting pharmaceutical companies, medical providers, and patients project can be broken down into the following key components:

A. User Authentication and Authorization

Objective: Ensure secure user access to the system.
Components:
Login Module: Handles user authentication securely, verifying credentials.
Role-based Access Control: Determines user roles (patients, doctors, administrators) and assigns appropriate permissions.
Ethereum Wallet Integration: Links user accounts with Ethereum wallets for decentralized authentication.

B. Patients' Data Module

Objective: Manage and secure patients' health information.
Components:
Patient Record Creation: Allows for the creation of patient records on the blockchain.
Medical History Management: Captures and securely stores medical history, prescriptions, and allergies.
Permission-based Access: Smart contracts enforce access control, allowing only authorized individuals to view or modify patient data.

C. Medicines Data Module

Objective: Facilitate the storage and retrieval of medicines information.
Components:
Medicine Database: Stores details about medicines, including composition, usage instructions, and side effects.
Traceability: Enables traceability of medicines on the blockchain for quality control.
Smart Contract Functions: Manages the integrity and accessibility of medicines data through smart contract functions.

D. Doctors' Data Module

Objective: Securely store and manage information about healthcare professionals.
Components:
Doctor Profile Creation: Allows for the creation and update of doctor profiles on the blockchain.
Credentials and Specialization: Captures and verifies doctor credentials, specialization, and professional history.
Access Controls: Smart contracts define access controls, protecting sensitive doctor information.

E. Web Application Interface (React.js)

Objective: Provide an intuitive and user-friendly interface for interaction.
Components:
Dashboard: Centralized hub for users to access different modules and functionalities.
User Profile Management: Allows users to manage their profiles and preferences.
Real-time Updates: Ensures real-time updates and notifications for users.

F. Smart Contracts Development and Deployment

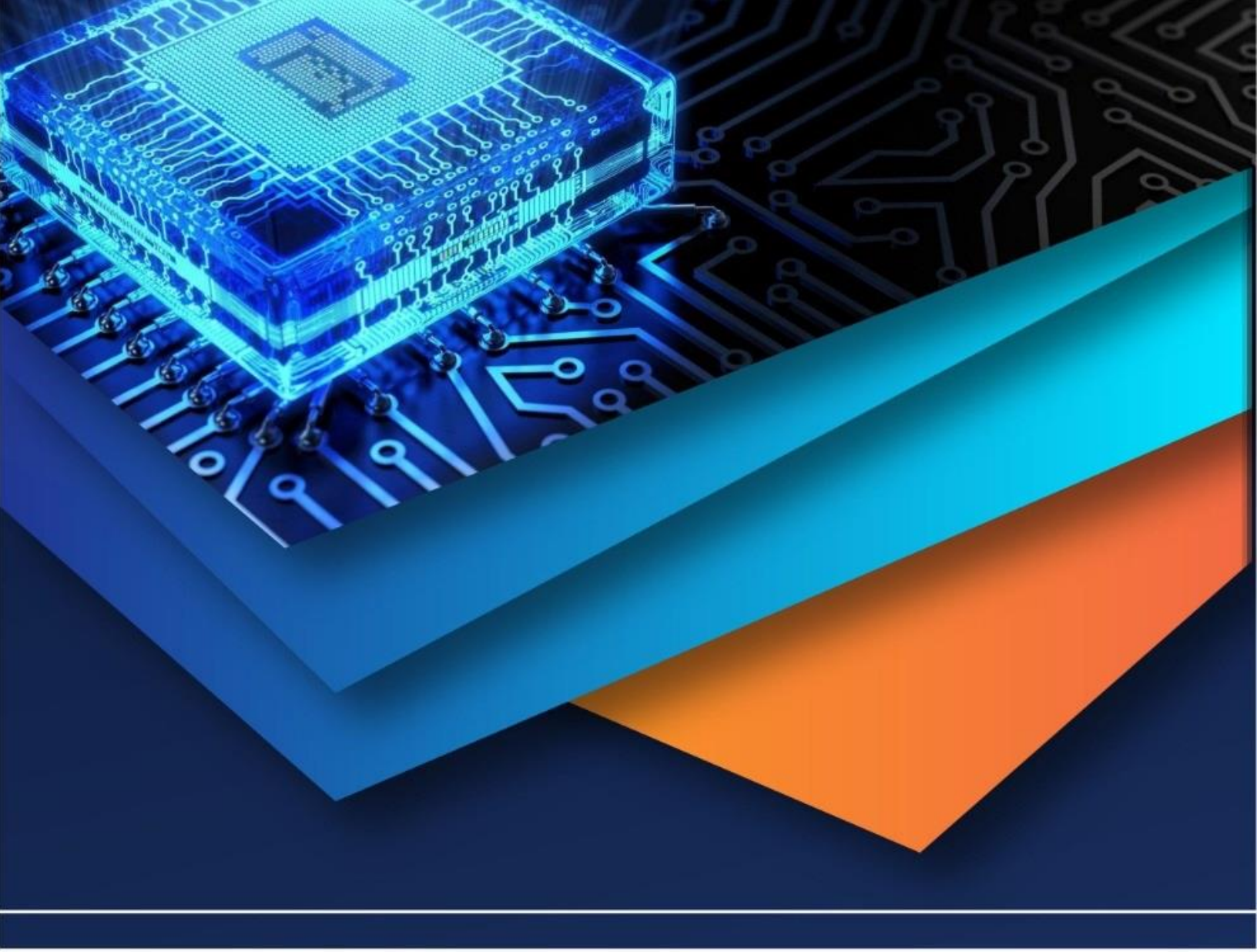
Objective: Establish the logic and rules for data transactions on the blockchain.
Components:
Remix IDE Integration: Utilizes Remix IDE for smart contract development and testing.
Gas Optimization: Smart contracts optimized for efficient gas consumption.
Upgradeable Contracts: Consideration for deploying upgradeable contracts for future enhancements.

VII. CONCLUSION

Healthcare data management has been gaining increasing attention in the last few years as it can provide more accurate, efficient, and cost-effective patient care. Blockchain technology has strong potential to improve the management of medical data because it can address issues such as single point of failure, data stewardship, system vulnerability, distributed information, and high security and privacy risks prevailing in the existing client-server and cloud-based approaches. However, most of the recent research efforts aimed at implementing blockchain in the healthcare domain have focused on the Bitcoin network. However, as we have mentioned previously, the Bitcoin network suffers from high energy consumption, low transaction throughput, limited scalability, and privacy and security threats. Consequently, there is a need for a more scalable and efficient blockchain architecture. In this paper, we have proposed a fast way blockchain architecture for healthcare data management that has low computational, and communication overhead as compared to the Bitcoin network. We implemented a scalable and energy-efficient consensus process in place of the Bitcoin network's energy-hungry mining consensus protocol.

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