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Blockchain Powered – Transparency in Organ Donation and Transplantation

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ABSTRACT: The field of transplantation of organs has emerged as one of the most important provinces in the healthcare industry. In the present contemporary world, many arising advancements have developed and are carefully automatized with the assistance of computer based intelligence, Cloud, Block chain, and so on and it brings imaginative answers for the basic issues to make new vogue. Patients and medical care specialists are confronted with the test of safely getting to, making due, incorporating, and sharing wellbeing records. The most profoundly requested viewpoints in the inter web are protection and security, and this is where blockchain assumes a prevalent part. It has elements like straightforwardness, decentralization, and permanence that make it vital. Organ gift being the most honorable deed requires revolutionization. One can't envision the criticalness and a distress an individual can feels when his/her cherished one is needing such demonstration and they couldn't find a proper contributor. Then again, individuals who wish to give stresses over the protection, security and credibility. The Proposed framework is an electronic Application which utilizes FIFO way to deal with select an organ benefactor for each certifiable patient requiring a transfer and in the event that there is a crisis case, the need is given to that understanding. It makes it easy for people who want to donate organs and those who need them to connect. It involves Blockchain as its hidden innovation.

KEYWORDS: Organ donation and transplantation, Blockchain, ECC (Elliptical curve cryptography) algorithm.

I. INTRODUCTION

The human body is quite delicate at times. Although extreme caution and attention must be taken, unfavourable events often occur that might result in organ failure. Many factors, including illnesses or aging that impact the heart, lungs, or kidneys, to mention a few, might be to blame for this. According to statistics, there are nations where individuals in need of organ transplants are added to a waiting list every ten to fifteen minutes. Every day, someone died as a result of being on this waiting list for organ recipients, and in June, there were 113,340 persons on the US waiting list. Organ donation is seen as a very important and noble deed, yet it is fraught with difficulties. There are various kinds of donors: living people who register as donors, meaning they are willing to donate their organs upon death; deceased donors whose relatives or close friends make the decision to donate their organs; Living people who choose to donate a non-essential organ while they are still alive; and occasionally a brain-dead individual. Applications exist that let users commit to organ donation once they pass away. Blockchain Technology and organ donation together constitute a significant development in healthcare that promises improved efficiency, security, and transparency. Our solution guarantees strong encryption of important organ donor data by using the Elliptic Curve Cryptography (ECC) technique, enabling safe transactions and protecting patient privacy. Organ compatibility and donor permission may be easily verified because to ECC's effective use of cryptographic keys, and its scalability complements the dynamic structure of organ transplant databases. Our network equips donors and recipients with a reliable, tamper-resistant infrastructure, transforming the organ donation process and perhaps saving countless lives. This is made possible by the decentralized and irreversible nature of blockchain technology combined with the encryption expertise of ECC.

BLOCKCHAIN TECHNOLOGY

Block chain is digital, decentralized, distributed ledger database where blocks are linked cryptographically, and transactions are digitally signed and managed using consensus model. Blockchains are typically managed through a

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peer-to-peer network to function as a publicly distributed ledger, where nodes collectively follow a protocol to communicate and validate new blocks. While blockchain records are not immutable due to the possibility of forks, they are inherently secure and showcase a distributed computing system with high Byzantine fault tolerance. Bitcoin became the first digital currency to solve double-spending without needing a trusted authority or central server through blockchain integration. Its design inspired many public-access blockchains used widely in cryptocurrencies. Blockchain is recognized as a form of payment infrastructure, and private blockchains have been proposed for corporate applications.

UNCHANGING NATURE

Changeless record in blockchain alludes to any records that can stay unaltered. It can't be modified and subsequently the information can't be changed easily, in this way ensuring that the security is very close. Permanence implies that making changes without collusion is undeniably challenging. The focal thought behind the blockchain record is the security of information and the evidence that information has not been changed or modified. Allow us to dig a piece further into the subject to see more about blockchain changelessness and the advantages it offers.

TIME STAMPED

Securely tracking a document's creation and modification times is accomplished through trusted time stamping. Security here implies that nobody — not even the proprietor of the report —ought to have the option to transform it whenever it has been recorded given that the times alters trustworthiness is rarely compromised. The regulatory perspective includes setting up an openly accessible, trusted timestamp the board framework to gather, process and restore timestamps.,

SMART CONTRACT

Deployment of a smart contract on a blockchain occurs by sending a transaction from a wallet for the blockchain, which is similar to transferring value on a blockchain. The exchange incorporates the gathered code for the savvy contract as well as an exceptional collector address. That exchange should then be remembered for a block that is added to the blockchain, so, all in all the shrewd agreement's code will execute to lay out the underlying condition of the brilliant agreement. Byzantine shortcoming open minded calculations secure the shrewd agreement in a decentralized manner from endeavours to mess with it. When a savvy contract is sent, it can't be refreshed. Shrewd agreements on a blockchain can store erratic state and execute inconsistent calculations. End clients communicate with a brilliant agreement through exchanges. Such exchanges with a brilliant agreement can conjure other savvy contracts. These exchanges could bring about meaningfully altering the state and sending coins starting with one savvy contract then onto the next or starting with one record then onto the next.

II. LITERATURE REVIEW

TabrezQuasim1,AlaaAbdElhad Radwan [3] The global health systems undergo significant transformations in terms of access, data processing, monitoring, and healthcare. The advances in information catching and associated innovation are supposed to deliver around 2314 exabytes of medical care information for 2020. Digital hoodlums put a ton of exertion for obtaining entrance of medical services information. By 2026, the cybersecurity market is expected to reach approximately $27.1 billion as a result of this challenge. The blockchain innovation will assist with shaping a brought together storehouse for information assortment in clinical examinations. This article proposes a safe framework utilizing blockchain to ensure the insurance of electronic medical services records (HER). The system incorporates sensors, Internet of things, data sets and other registering assets. This structure for getting HER will work on the security, protection of HER when contrasted with customary medical care framework.

The broad adoption of electronic medical records [4] could benefit from blockchain technology, which offers advantages in data integration and security. Recent academic studies exploring blockchain's application in managing medical records have revealed that individuals can maintain complete control over their personal health data. Ensuring accurate and consistent data is crucial for effective and transparent data exchange. Decentralized data storage is considered the most effective approach for enhancing storage functionality. Unlike the current client-server architecture employed by organ management systems, which poses risks of data loss and recovery challenges in case of server failures, this research proposes using blockchain technology to enhance organ donation management (ODMS).

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Healthcare is a globally sensitive topic, and medical research plays a vital role in improving human life. With advancements in technology, ensuring security has become increasingly important, particularly in organ and blood donation systems, which need to be both secure and transparent. During emergencies, locating information about organ and blood donors can be challenging. This study [5] proposes the development of an online application called OraB for organ and blood donors. OraB is a community-driven platform aimed at creating a decentralized web application that securely connects donors with recipients, eliminating the need for third-party networks. The platform utilizes Vanilla JS, Web3.js, and Solidity for its front-end, back-end, and smart contract functionalities. By leveraging blockchain technology, this platform efficiently and cost-effectively records information about organ donors.

The decentralized nature, tamper-resistant features, and distributed storage capabilities of blockchain enable the tracking of production, processing, quality control, storage, transit, and sales of costly Chinese herbal remedies. This paper [6] delves into designing a dual-chain traceability system for rare Chinese herbal medicines. It involves storing the specifics of each process in the public blockchain, the Hash value of each production process's traceability information in the private blockchain, and the transaction identification ID. Enhancing the system's reliability and security entails recording the hash value of the traceability data during the final sales in a consortium blockchain transaction. The consortium blockchain handles the bulk of data manipulation and verification, while the private blockchain solely captures and stores data regarding the chain's progression.

The paper [7] examines how health services Integrate E-Government applications, Tele-Medicine, and Artificial Intelligence. It explores the impact of sharing patient and disease data among healthcare stakeholders using Blockchain Technology and smart contracts. It delves into the theoretical underpinnings of blockchain technology within the current framework and analyses its implementation in the healthcare sectors of Estonia, Sweden, and the USA. Furthermore, it assesses how these implementations affect the costs associated with health services.

III. METHODOLOGY OF PROPOSED SURVEY

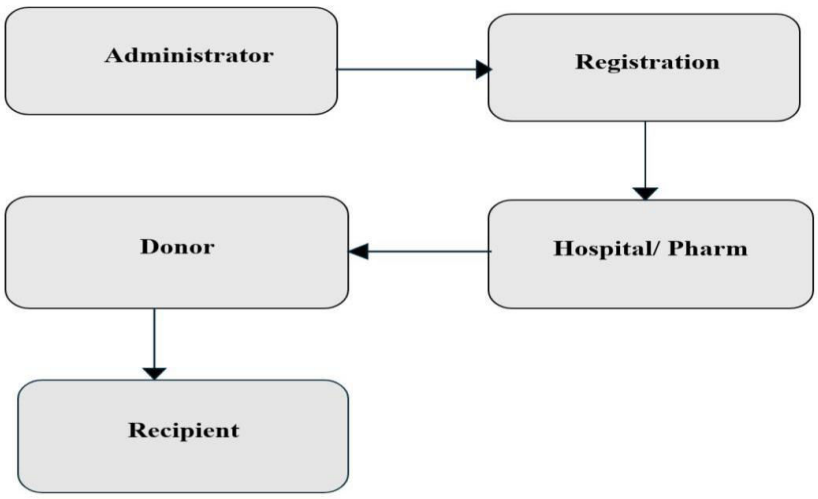

Figure 1. Work flow methodology

The proposed framework is a block chain-based admittance control framework engineering that stores the hash of the client's information rather than straightforwardly putting away the first information and in this way saving the client's security. The proposed blockchain calculation, for example, the ECC Elliptic Curve Cryptography calculation is utilized. Block chain has been looked at as a possible solution for healthcare systems' security and efficiency problems. The medical and organ donation fields make up our system. The medication gift is for the penniless individuals, they can't bear the cost of a lot of expenditure just for clinical purposes. Benefactor can enlist and NGOs can gather it and give it to the beneficiary.

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ADMINISTRATOR

There is a admin login with the user login the admin can login through the username and password under the donor there is a distributed ledger with a block number times stamp data previous block hash and current block has all the details are viewed.

REGISTRATION

In the mainframe there is a register options where the user can choose the hospital /pharm or donor or recipient after choosing a particular role the user can able to register with the first name, last name ,email id and mobile number so after the registration the date of provided by the blocks in will be added successfully so the hash ID will also be generated.

HOSPITAL/PHARMACY

Hospital/Pharmacy facilitates organ procurement, transplantation procedures, and medication management. Hospitals/pharmacies interact with the blockchain to record patient information, organ availability, and medication dispensation securely.

DONOR

In the organ donation tab the hospital name with age, blood group and the body parts can be added by the donor as he/she is the organ donator along with that the medicine can be donated in the medicine donation tab with medicine name, manufacturer medicine type, packet size, hospital name and description along with expiry dates.

RECIPIENT

In the recipient page the distributed ledger of the blockchain and the organ needed along with the medicine needed of the three types are specified. The dawn or name, manufacturer, medicine type, packet size, expiration date, description status, and hospital name can be viewed in the medicine need tab after selecting a hospital.

ALGORITHM EXPLANATION

Elliptical curve cryptography (ECC) is a public key encryption technique based on elliptic curve theory that can be used to create faster, smaller and more efficient cryptographic keys. ECC is an alternative to the Rivest- Shamir-Adleman (RSA) cryptographic algorithm and is most often used for digital signatures in cryptocurrencies, such as Bitcoin and Ethereum, as well as one-way encryption of emails, data and software. An elliptic curve is not an ellipse, or oval shape, but it is represented as a looping line intersecting two axes, which are lines on a graph used to indicate the position of a point. The curve is completely symmetric, or mirrored, along the x-axis of the graph. Public key cryptography systems, like ECC, use a mathematical process to merge two distinct keys and then use the output to encrypt and decrypt data. One is a public key that is known to anyone, and the other is a private key that is only known by the sender and receiver of the data.ECC generates keys through the properties of an elliptic curve equation instead of the traditional method of generation as the product of large prime numbers. From a cryptographic perspective, the points along the graph can be formulated using the following equation:

$$Y\text{^}2 = x\text{^}3 + ax + b \qquad (1)$$

To generate a pair of ECC keys, a user selects a random private key D and computes the corresponding public key from the following equation:

$$Q = dG \qquad (2)$$

where G is a predefined base point on the elliptic curve. To encrypt a message using ECC, the sender uses the recipient's public key to derive a shared secret, which is then used to encrypt the message. The recipient can then use their private key to decrypt the message. ECC offers strong security with smaller key sizes compared to other public-key cryptographic algorithms like RSA. This makes ECC particularly well-suited for environments where resources (such as bandwidth and computational power) are limited.

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Table 1. Comparison table

Algorithm	Accuracy	Precision	Recall	F-measure
Existing system	0.84	0.79	0.75	0.84
Proposed system	0.88	0.9	0.87	0.98

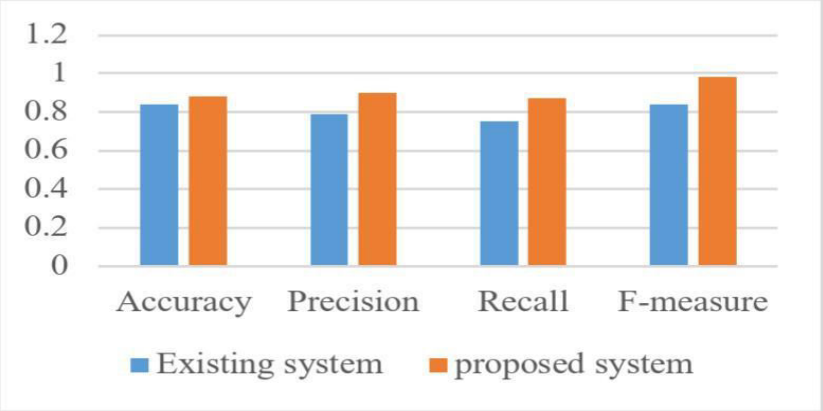

Figure 2. Comparison graph

The comparison of the present and proposed systems reveals considerable increases in accuracy, precision, recall, and F-measure metrics. While the current system performs admirably with an accuracy of 0.84, precision of 0.79, recall of 0.75, and F-measure of 0.84, the proposed system outperforms these metrics with significant improvements, achieving an accuracy of 0.88, precision of 0.90, recall of 0.87, and F-measure of 0.98. These findings demonstrate the usefulness of the proposed framework, which combines sophisticated technologies such as blockchain and elliptic curve encryption to improve data security, privacy, and accessibility in organ donation operations. With greater precision and recall ratings, the suggested approach proves its potential to reliably connect organ donors to receivers while effectively prioritizing emergency situations. The huge rise in F-measure highlights the overall improvement in system performance, demonstrating a major progress in organ donation procedures made possible by the proposed framework.

IV. RESULTS AND DISCUSSION

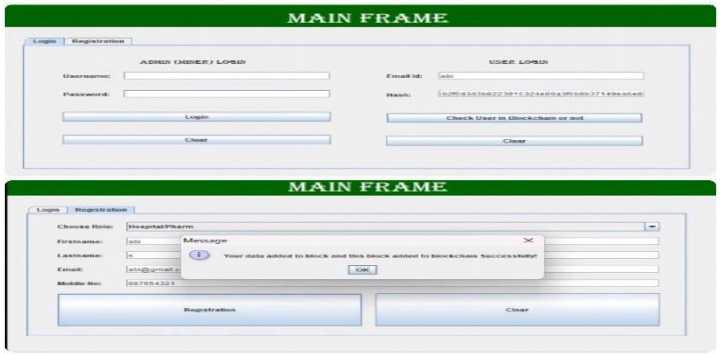

Figure 3. Admin login and registration tab

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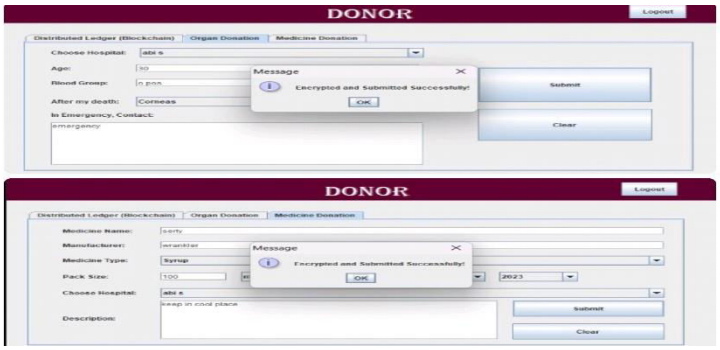

Figure 4. Organ donation and medicine donation tab

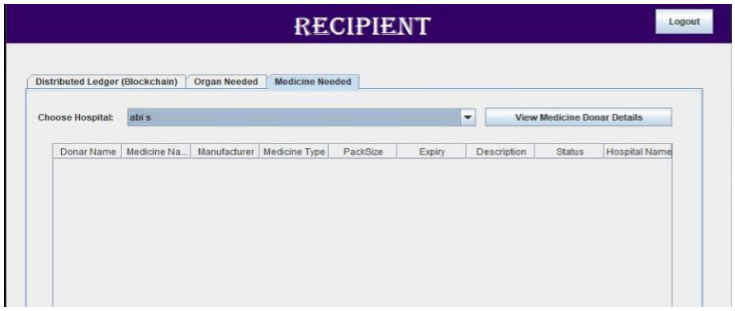

Figure 5. Recipient tab

The suggested framework for organ donation, which uses blockchain technology and powerful cryptographic algorithms, appears to be a potential answer to the severe difficulties that healthcare institutions confront. The framework's priority of privacy, security, and efficiency strives to simplify the organ transplantation procedure while guaranteeing fair access for patients in need. The use of blockchain for access control and data storage improves openness and decentralization while also addressing concerns about the validity and privacy of healthcare information. Furthermore, expanding the framework to incorporate medicine donation highlights its potential to address larger social needs, particularly among the financially underprivileged. Overall, the suggested paradigm marks a significant step in revolutionizing organ donation processes while also improving the efficacy and accessibility of healthcare systems.

V. CONCLUSION AND FUTURE WORK

Organ donation is a noble act that saves and improves the lives of countless individuals. However, the process of organ donation and transplantation is complex and often faces numerous challenges, including the need for a secure and efficient system to manage and track organ donations. Our proposed block chain-based access-control system architecture aims to address these challenges by providing a secure and transparent platform for managing organ donations. One of the key features of our system is the use of block chain technology to store the hash of the user's data instead of directly storing the original data. This approach helps to preserve the user's privacy while still allowing for secure and efficient access control. The block chain algorithm we use, such as the ECC, ensures that the data stored in the blockchain is tamper-proof and secure. In the context of organ donation, our system could be used to create a secure and transparent platform for managing organ donations. Donors could register their willingness to donate organs, and the block chain could be used to securely store and track organ donation information. This would help to ensure that organs are allocated fairly and efficiently, and that the wishes of donors are respected.

The proposed system digitalizes the process of organ donation, enhances the existing system by handling endless data, and provides a transparent and cost-effective system. The simulation for medicine and organ donation is secure and transparent. It can also upload the EMR of patients to the distributed server to generate a hash value for anywhere access. The proposed Framework is quicker, safer and more adaptable. The organ recipient and contributor

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should rest assured about the legitimacy of the other decisively. The Organ Gift Framework permits no outsider access. The framework disposes of the debasement in division of organ gift through a straightforward framework and the patients will actually want to get the organ before it is past the point of no return. This system aims to overcome challenges by offering a secure and transparent platform. In Future we would entail developing, testing, and refining the system, ensuring regulatory compliance, educating users, and continuously improving the technology based on feedback and advancements in blockchain and organ donation management.

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