# Human Organ Donation Management System Using Block Chain

Nathiya N
CSE
Paavai College of Engineering
Namakkal,TamilNadu
nathiiraj@gmail.com

Seenuvasan M
CSE
Paavai College of Engineering
Namakkal,TamilNadu
seenuvasan39987@gmail.com

ShamPrasath A S
CSE
Paavai College of Engineering
Namakkal, TamilNadu
shamprasath1211@gamil.com

Tamilselvan M
CSE
Paavai College of Engineering
Namakkal, TamilNadu
tamilselvanm1109@gmail.com

Tharunkumar M
CSE
Paavai College of Engineering
Namakkal,TamilNadu
Tharunkumar6302@gmail.com

**Abstract:**

The organ donation process is a complex and sensitive issue that requires a secure and transparent system for managing organ donation requests, organ matching, and organ transfers. A blockchain-based organ donation application can offer a secure, decentralized, and transparent platform for managing the organ donation process. The proposed blockchain-based organ donation application will use a permissioned blockchain network to manage the organ donation process. The network will include organ donors, recipients, hospitals, and other organizers in the organ donation process. Each user will have a unique digital identity and will be able to access the network through a secure login. The organ donation application will use blockchain technology to automate the organdonation process. The organizers will be verifying the eligibility of organ donors and recipients, match donors with recipients based on compatibility, and manage the organ transfer process. The smart contracts will also ensure that all organ donation transactions are recorded on the blockchain network in a secure and transparent manner. The blockchain-based organ donation application will also include a user interface that will allow stakeholders to manage their organ

donation requests and view the status of their organ donation transactions. The user interface will be designed to be user-friendly and accessible to stakeholders with varying levels of technical expertise. The use of a blockchain-based organ donation application can improve the efficiency and transparency of the organ donation process, reduce the risk of fraud and errors, and increase public trust in the organ donation system. With a secure and transparent platform for managing organ donation requests, organ matching, and organ transfers, more lives can be saved through organ donation.

Keywords: Substitution technique, Recovery Algorithm, Playfair cipher technique.

## 1.INTRODUCTION

Blockchain builds on the idea of P2P networks and provides a universal data set that every actor can trust, even though they might not know or trust each other. It provides a shared and trusted ledger of transactions, where immutable and encrypted copies of information are stored on every node in the network. Economic incentives in the form of native network tokens are applied to make the network fault tolerant, and attack and collusion resistant.

### 1.1 BLOCKCHAIN TECHNOLOGY

Blockchain and derived technologies provide a universal and transparent accounting and governance layer for the Internet. All network participants have equal access to the same data in real-time. Transactions running over the network are transparent to all actors

and can be traced back to their origin. Blockchain can also be described as a distributed accounting machine or a supranational governance machine that is public and transparent. When the network validates a transaction by majority consensus, the transaction is permanently written to the blockchain. Otherwise, the transaction is rejected and does not go through. Only transactions that have been included in the blockchain are considered as valid and final. A Blockchain protocol operates on top of the Internet, on a P2P network of computers that all run the protocol and hold an identical copy of the ledger of transactions, enabling P2P value transactions without a middleman though machine consensus.

Blockchain technology is a digital ledger that allows multiple parties to access and share data in a secure, transparent, and decentralized manner. The technology is based on a distributed database that uses cryptography to create a chain of blocks containing transactional data. Each block is linked to the previous one, forming an immutable and tamper-proof record of all transactions. The first and most well-known implementation of blockchain technology is Bitcoin, a digital currency that allows for secure and anonymous transactions without the need for a central authority. However, blockchain technology has since expanded beyond the world of finance and is now being used in a variety of industries, including supply chain management, healthcare, real estate, and more.

1.2.ELEMENTSOFBLOCKCHAIN

TECHNOLOGY

Distributed ledger technology:All network participants have access to the distributed ledger and its immutable record of transactions. With this shared ledger, transactions are recorded only once, eliminating the duplication of effort that's typical of traditional business networks.

Immutable records:

No participant can change or tamper with a transaction after it's been recorded to the shared ledger. If a transaction record includes an error, a new transaction must be added to reverse the error, and both transactions are then visible.

Smart contracts:

To speed transactions, a set of rules — called a smart contract — is stored on the blockchain and executed automatically. A smart contract can define conditions for corporate bond transfers; include terms for travel insurance to be paid and much more.

2.RELATED WORK

We provided a brief overview of all relevant models and the closest rival to our proposed investigation in the literature review section. For this analysis, we concentrated on the most current research publications published in the prior two years.

1. Creating organ donation system with blockchain technology

**Authors:** Soni, Anmol, and S. Ganesh Kumar.

Proposed System is a web-based Application which uses FIFO approach to select an organ donor for each genuine patient requiring a transplant and if there is an emergency case then the priority is given to that patient. It provides an efficient platform for potential organ doners and those who need the organs to connect. It uses Blockchain as its underlying Technology. Blockchain Technology is as it is known a decentralized and distributed network which stores records that are immutable as in cannot be altered once saved. The Immutability of Blockchain Technology provides the required security to the application. Blockchain Technology uses digital documents which are digitally signed by the user so that they are time stamped at the time of saving the document and cannot be changed after that. It solves the issue of authenticating the same user again and again. 2. Organ donation decentralized application using blockchain technology

**Authors:** Dajim, Lama Abdulwahab, Atheer Abdullah Al-Zuraib, and Rincy Merlin Mathew.

Propose a blockchain based organ donation website that would secure and automate the organ donation process while protecting sensitive patient and donor medical records using blockchain technology to eliminating any possibility of manipulation. It is designed specifically for use in the medical field related to organ donations, hospitals,

patients, organizing the donation process, and making it accessible while maintaining the integrity of the system. It will provide an easy solution to maintain the anonymity of medical records. Blockchain is a distributed database that has the ability to manage an ever-growing list of named logs (blocks), with each block containing a time stamp and a link to the previous block. Each set of transactions is linked to a series, which gives all participants a comprehensive picture of the entire system. The series of blocks is designed so they can retain the data stored in them without modification, meaning information is stored in a cluster chain.

3. EACMS: Emergency access control management system for personal health record based on blockchain

**Authors:** Rajput, Ahmed Raza, Qianmu Li, MiladTalebyAhvanooey, and IsmaMasood.

Propose an emergency access control management system (EACMS) based on permissioned blockchain hyperledger fabric and hyperledger composer. In the proposed system, we defined some rules using the smart contracts for emergency condition and time duration for the emergency access PHR data items that patient can assign some limitations for controlling the PHR permissions. We analyzed the performance of our proposed framework by implementing it through the hyperledger composer based on the response time, privacy, security, and accessibility. In the PHR system, the patient introduced the emergency contact for the emergency condition because the patient is unconscious and unable to permit his PHR access. Consent management and data fetching are complicated and inconvenient the EMT staff need to contact emergency contact person in the PHR, and the emergency contact person did not reply on time at any cost, or some other problem may occur with the emergency contact person then what will do the EMT staff at the emergency condition? The patient after cure can trace the existing information in a PHR system that if any doctor already entered with the permission of emergency contact person behalf of the patient, there is no any record to show the tracking. By operating permissioned blockchain technology, our solution provides an ED access for expediting the consent management and speeding up PHR data fetch from the PHR system. We developed a smart contract that will enable a patient to impose permission access control policy for his/her data items easily and permits dynamic PHR data for sharing to ED during the emergency condition.

4. Privacy-friendly platform for healthcare data in cloud based on blockchain environment

**Authors:**AlOmar,Abdullah,ShinsakuKiyomoto, and Mohammad ShahriarRahman.

Present a patient centric healthcare data management system using blockchain technology as storage which helps to attain privacy. Cryptographic functions are used to encrypt patients data and to ensure pseudonymity. Here analyze the data processing procedures and also the cost effectiveness of the smart contracts used in our system. The main idea of this work is to keep the sensitive healthcare data on the blockchain to attain accountability, integrity and security. Patients will have the overall control over the blocks in which their data will be stored. Present healthcare systems lack in pseudonymity as that only store the data in cloud, but our platform ensures the pseudonymity of patients. We achieve pseudonymity by using cryptographic functions. MediBchain will regain the interest of patients on EHR systems and will retain accountability, integrity, pseudonymity, security and privacy which are being lost with the increasing computational power of emerging technologies in EHR systems.

5.A novel EMR integrity management based on a medical blockchain platform in hospital

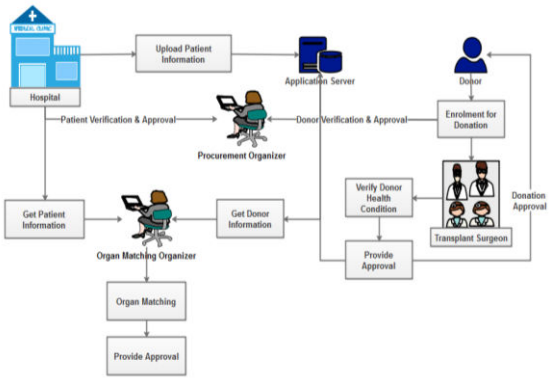
**Authors:** Hang, Lei, Eunchang Choi, and Do-Hyeun Kim.

Implement a blockchain-based medical platform using a smart contract to secure the EMR management. This approach provides patients a comprehensive, immutable log and easy access to their medical information across different departments within the hospital. A case study for hospital is built on a permissioned network, and a series of experimental tests are performed to demonstrate the usability and efficiency of the designed platform. Lastly, a benchmark study by leveraging various performance metrics is made and the outcomes indicate that the designed platform surpasses the ability of existing works in various aspects. More precisely, the medical blockchain network consists of trusted validating peers and each peer holds a copy of the ledger for the network in order to maintain the consistence of the distributed ledger. The ledger consists of a blockchain to store the immutable, sequence transaction record in blocks, and a data lake to maintain various medical data. The blockchain is a transaction log that records all the changes resulted in the data lake while the data lake is an off-chain state database that holds the current values of a set of data, for example, the latest EMR of a patient. Moreover, the patient is allowed to set up the access permission of their medical information to any other doctors within the network. This is realized by specifying the access control policy in the smart contract, which will be deployed into the entire blockchain network to ensure the patient's privacy and data security.

## 3.METHODOLOGY

Evaluate the capabilities and limitations of blockchain technology. Consider factors like scalability, security, privacy, and interoperability. Identify the appropriate blockchain platform (public or private) and consensus mechanism that aligns with your project requirements. Research the legal and regulatory landscape surrounding organ donation systems. Ensure compliance with relevant healthcare, privacy, and data protection laws. Determine how blockchain fits within these frameworks and if any modifications are required. Identify the key stakeholders involved in the organ donation process, such as patients, organ donors, healthcare providers, hospitals, and regulatory authorities. Understand their requirements, concerns, and potential benefits of using a blockchain system. Engage stakeholders to gather feedback and support Define the architecture of the blockchain-based organ donation system. Determine the data that needs to be stored on the blockchain, such as patient profiles, organ availability, and transplantation records. Consider integrating existing systems, like electronic health records, to ensure interoperability.Assess the technical feasibility of implementing the system. Consider factors like infrastructure requirements, blockchain development expertise, and integration challenges. Determine the costs associated with development, deployment, and maintenance.

## 4.SYSTEM ARCHITECTURE




## 5.IMPLEMENTATION

The proposed work has six stages of Implementation

Framework Creation

Hospital Process

Donor Enrolment

Procurement Organizer

Transplant Surgeon Verification

Organ matching Organizer

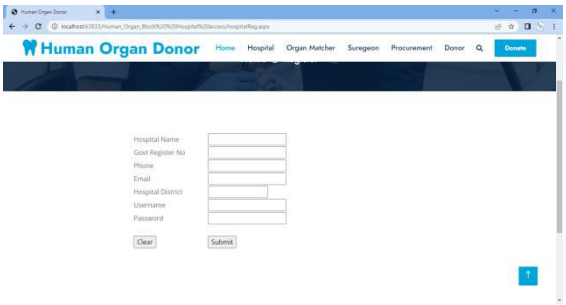
1.Frameork Creation

A blockchain is a decentralized, distributed digital ledger that allows secure transactions and information sharing without the need for

intermediaries. The organ donation system could leverage the security and transparency of blockchain technology to securely store and share patient and donor information. The system would allow patients in need of organ donations to register their information, including their medical history, organ needed, and contact information. Similarly, potential donors could register their information, including their blood type, organ availability, and contact information.

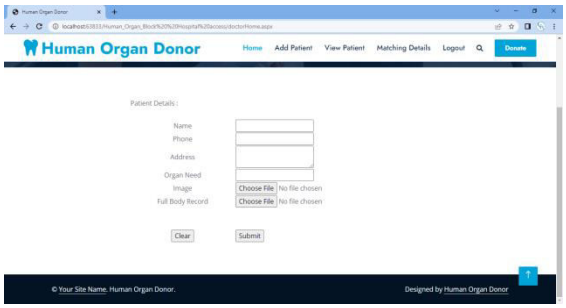

2.Hospital Process

The organ donation system is a medical program that aims to facilitate the donation of organs from deceased or living donors for transplantation to patients in need of an organ transplant. In this module, the hospital would be responsible for registering patient data related to their need for an organ transplant. This data may include the patient's medical history, diagnosis, and specific organ transplantation requirements. The doctor would also need to ensure that the patient's data is accurate, up-to-date, and complete in order to facilitate the organ donation process.



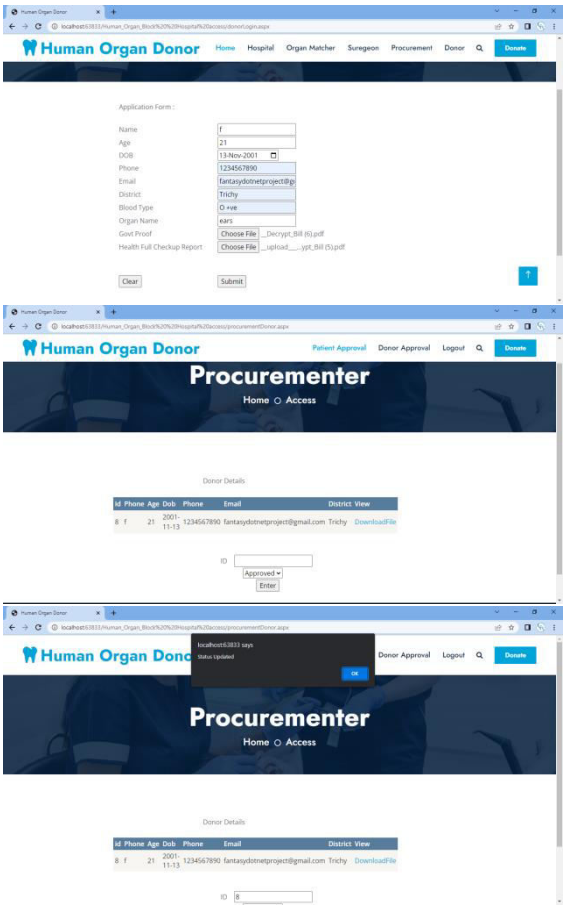

3.Donor Enroment

The donor registration module in the organ donation system is a crucial component that allows individuals to voluntarily sign up to donate their organs after they pass away. This module involves several steps, including educating potential donors about the process, gathering and storing their personal information, and ensuring that their wishes.Once an individual has decided to register as an organ donor, their personal information is collected and stored in a secure database. This information typically includes their name, contact details, and medical history, as well as their consent to donate their organs.



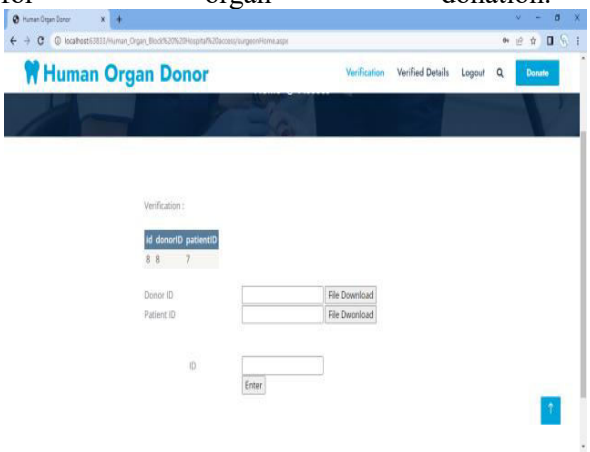

4.Procurement Organizer

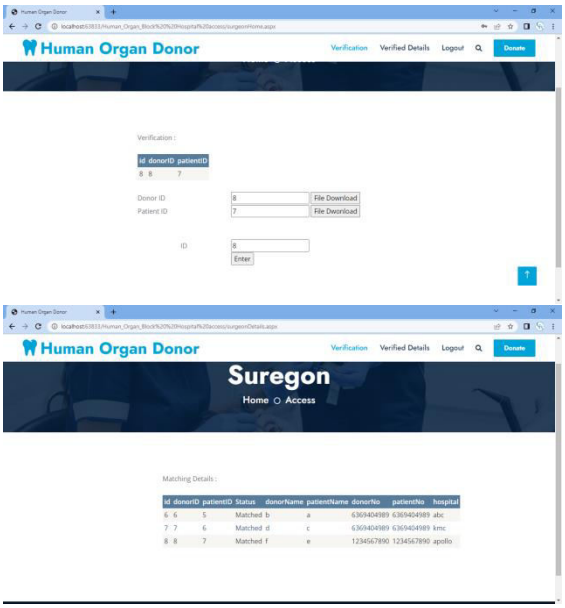
The procurement organizer is a verifier for patient and donor. The first step is to verify the identity of both the donor and the patient. This includes confirming their full name, date of birth, and other personal information. Procurement organizer verified the both donor and patient with their registered information. The procurement organizer must ensure compliance with all applicable regulations and laws related to organ donation.




5.Transplant Surgen Verfication .

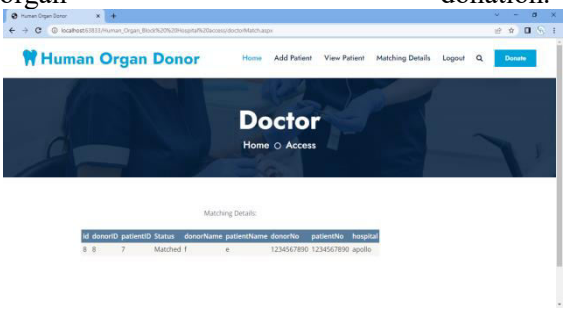
Transplant surgeon verification is the process of confirm that the donor is medically eligible to donate their organ. The registered donor details are shown to the transplant surgeon. Then transplant surgeon verifies the details. This involves verifying medical records, conducting medical tests, and ensuring compatibility. After completion of verification process transplant surgeon provide approval for organ donation.




6.OrganMatchng Organizer.

Organ matching organizer is the process of organizing donation process. Here verified organ donor details are gathered from transplant surgeon team. Also get patient information from procurement organizer. The details of both donor and patient details are verified and allocated by procurement organizer. Organ matching organizer finally provides approval and finishes the process of organ donation.




## 6 SYSTEM DEVELOPMENT

Both the sender and the receiver are involved in the Secure Hiding and Sharing of Messages procedure while transferring a message. A key table and key pool are provided in advance to the sender and receiver. Every time the key is used, it must be replaced, and when the key table is empty, a new one is distributed over secret channels. The message is encoded into a DNA code first, then substituted to form the secret message (SM) using a replacement sequence (Sub) retrieved from the key pool by PCR with the key. A substitution algorithm with a random substitution sequence is utilised to bring randomness into the SM. However,

because DNA code contains language information, it cannot be completely randomised; therefore, random SMs are generated by performing substitutions with a different sequence each time. The SM is then concealed in living cells with random DNA sequences to produce an encoded message (IC), which is then transmitted to the receiver via public channels. The receiver can recover the SM and Sub byutilising the key in PCR and then using the DNA substitution square to reconstruct the original message.

## 7.RESULTS

Organ donating has several advantages:

The people in need of organ can easily get donors by proposed information tracking system using blockchain

. It saves time as he can search donors online without going anywhere. Using this system user can get organ in time and can save.

Blockchain assures the integrity of shared information by both patients and organ donors. To achieve successful data concealing, the data being concealed should contain error correction/redundancy.

The Benefits of donating data storge

This would help prevent fraud and ensure that sensitive information is not compromised. A blockchain-based organ donation system with patient and donor registration could help improve the efficiency, transparency, and security of the organ donation process. The use of smart contracts would automate the organ matching and allocation process, while the blockchain technology module would ensure that all information is stored securely and transparently.

## 8 CONCLUSION

Here implemented a blockchain-based organ donation system with patient and donor registration. In conclusion, the application of blockchain technology in organ donation has the potential to significantly improve the transparency, security, and efficiency of the organ donation process. By creating a decentralized and tamper-proof system, blockchain technology can increase trust among all stakeholders and reduce the risk of fraud or corruption. Additionally, the use of smart contracts can automate many of the processes involved in organ donation, reducing administrative burdens and ensuring that organs are allocated fairly and efficiently. Overall, the use of blockchain technology in organ donation has the potential to save countless lives and improve the healthcare system for everyone. However, it is important to recognize that implementing such a system would require significant collaboration and investment from governments, healthcare providers, and other stakeholders.

## REFERENCES

[1] Soni, Anmol, and S. Ganesh Kumar. "Creating organ donation system with blockchain technology." European Journal of Molecular and Clinical Medicine 8, no. 03 (2021).

[2] Dajim, Lama Abdulwahab, Sara Ahmed Al-Farras, Bushra Safar Al-Shahrani, Atheer Abdullah Al-Zuraib, and Rincy Merlin Mathew. "Organ donation decentralized application using blockchain technology." In 2019 2nd International Conference on Computer Applications & Information Security (ICCAIS), pp. 1-4.IEEE, 2019.

[3] Rajput, Ahmed Raza, Qianmu Li, MiladTalebyAhvanooey, and IsmaMasood. "EACMS: Emergency access control management system for personal health record based on blockchain." IEEE Access 7 (2019): 84304-84317.

[4] Chen, Lanxiang, Wai-Kong Lee, Chin-Chen Chang, Kim-Kwang Raymond Choo, and Nan Zhang. "Blockchain based searchable encryption for electronic health record sharing." Future generation computer systems 95 (2019): 420-429.

[5]AlOmar,Abdullah,MdZakirulAlamBhuiyan AnirbanBasu,ShinsakuKiyomoto,and MohammadShahriarRahman."Privacy-friendly platform for healthcare data in cloud based on blockchain environment." Future generation computer systems 95 (2019): 511-521.

[6] Hang, Lei, Eunchang Choi, and Do-Hyeun Kim. "A novel EMR integrity management based on a medical blockchain platform in hospital." Electronics 8, no. 4 (2019): 467.

[7] Ranjan, Pratyush, ShubhankerSrivastava, Vidit Gupta, ShashikalaTapaswi, and Neetesh Kumar. "Decentralised and distributed system for organ/tissue donation and transplantation." In 2019 IEEE Conference on Information and Communication Technology, pp. 1-6.IEEE, 2019.

[8] M. Hölbl, M. Kompara, A. Kamišalić, and L. N. Zlatolas, ‘‘A systematic review of the use of blockchain in healthcare,’’ Symmetry, vol. 10, no. 10, p. 470, Oct. 2018, doi: 10.3390/sym10100470.

[9] V. Ferraza, G. Oliveira, P. Viera-Marques, and R. Cruz-Correia, ‘‘Organs transplantation—How to improve the process ?’’ Eur. Fed. Med. Inform., Cardiff, U.K., Tech. Rep., 2011.

[10] A. Bougdira, A. Ahaitouf, and I. Akharraz, ‘‘Conceptual framework for general traceability solution: Description and bases,’’ J. Model. Manage., vol. 15, no. 2, pp. 509–530, Oct. 2019.

[11] N. Mattei, A. Saffidine, and T. Walsh, ‘‘Mechanisms for online organ matching,’’ in Proc. 26th Int. Joint Conf. Artif.Intell., Aug. 2017, pp. 345–351.

[12] S. Zouarhi, ‘‘Kidner—A worldwide decentralised matching system for kidney transplants,’’ J. Int. Soc. Telemed. E-Health, vol. 5, Apr. 2017, Art.no. e62.

[13] L. A. Dajim, S. A. Al-Farras, B. S. Al-Shahrani, A. A. Al-Zuraib, and R. M. Mathew, ‘‘Organ donation decentralized application using blockchain technology,’’ in Proc. 2nd Int. Conf. Comput. Appl. Inf. Secur. (ICCAIS), May 2019, pp. 1–4.