IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Online Organ Donation System Using Blockchain

Prof. V.V Waykule[1], Rushikesh Kothawade[2], Ritesh Nikam[3], Harsh Khandelwal[4], Priyanshu Sharma[5], Dept of Computer Science and Engineering, AISSMS College of Engineering Pune Maharashtra, India.

ABSTRACT In India, the prevalence of oran donation is limited, and even among the educated segments of society, there is a deficiency in both awareness and favourable perspectives regarding organ transplantation. The primary goal of this work is leveraging blockchain technology to enhance transparency, security and efficiency in organ donation processes.

INDEX TERMS: Python Django, Web3, Solidity, Metamask, Bootstrap, JQuery, Ajax, Ethereum Blockchain, AWS EC2 Instance.

I. INTRODUCTION

Organ donation is currently not widespread in India, and even among the educated sections of society, there is a lack of knowledge and positive attitudes toward organ transplantation. This has resulted in organ scarcity in the country. Some of the main concerns contributing to this scarcity include a lack of awareness and consciousness among the population, as well as the presence of mythological beliefs and misconceptions surrounding organ donation, often influenced by religious and cultural barriers.

This paper proposes the use of a private Ethereum blockchain system to facilitate organ donation and transplantation in a decentralized, secure, trackable, auditable, private, and trustworthy manner. Organ donation has significantly impacted the medical field, and many individuals express a desire to donate their organs, whether they are alive, deceased, or brain dead.

One of the main challenges in organ donation is the delay in organ supply, leading to the unfortunate loss of many lives in need. To address this issue, the authors suggest utilizing blockchain technology, which is a distributed database capable of handling dynamic datasets.

The proposed system ensures that participants receive a comprehensive overview of the entire organ donation procedure. By implementing blocks to store entered data, the process becomes more streamlined. Blockchain technology guarantees that no unauthorized access or modifications can be made to the data, thus ensuring the utmost security for all transactions.

Additionally, the authors aim to develop a weight verification mechanism for the organ container to ensure the physical safety of the organs. This system will automatically alert and notify the administration if any changes in the container's weight are detected, further enhancing safety measures.

The paper proposes leveraging a private Ethereum blockchain system to revolutionize organ donation and transplantation by providing a secure, efficient, and transparent platform for managing organ-related data and ensuring the safety of organs throughout the process.

The project has the following objectives:

1. The primary objective is to streamline the entire process by utilizing multiple blocks in a sequential manner.
2. To establish a decentralized and distributed access system to enhance efficiency and reduce reliance on a single node.

II. LITERATURE SURVEY

1) The system operates by linking hospitals, donors, and recipients securely through the use of blockchain technology. The paper highlights the requirements for developing such a system and emphasizes the importance of managing application security.

To ensure the security of the application, a multi-variant approach is proposed for donor identification. This approach involves capturing the donor's portrait image and assigning a unique identification number for recognition purposes. In the event of an accident or tragedy, neighbouring hospitals can identify the donor's face and easily retrieve the relevant user information. This retrieved information is then matched to determine if the person is a registered donor or not.

Furthermore, the system incorporates an authentication number, which is provided during the user registration process. This number adds an additional layer of authentication and verification for users.

2)This paper stands out from other research papers on organ donation and online management systems because it goes beyond discussing organs and donations. It explores the psychological impact of organ donation on donors and how they are treated by society after becoming donors. Additionally, the paper emphasizes the crucial role of Health Professionals (HPs) in the organ donation process. It highlights the significance of obtaining consent from the donor's family, which often acts as a barrier to higher donation rates.

The paper offers various strategies for HPs to increase organ donation rates, including search strategies, evaluating the analysis of pre-and post-success/failure of consent acquisition, data extraction, and data analysis. These strategies can be applied to our project. Even though our app/website may not directly act as an HP, we can implement similar practices. For example, incorporating motivational thoughts or utilizing smart algorithms (if feasible in the future) to enhance organ donation rates while ensuring the emotional and holistic well-being of the donor. It is essential not only for the donor's family but for society as a whole to respond with pride and appreciation for their contribution.

Overall, this paper provides valuable insights into the psychological aspects of organ donation, the role of HPs, and strategies to increase donation rates. We can incorporate these findings into our project to foster a positive organ donation experience and encourage societal support for donors.

3) This paper has an approach as it explores the correlation between religious beliefs, socioeconomic status, and organ donation. It sheds light on the role of education in organ transplantation and donation. The paper demonstrates how promoting education and knowledge can contribute to increasing the number of organ donors. It suggests utilizing effective sources of information such as television, newspapers, and radio to disseminate information about organ donation. We can incorporate these findings into our application by implementing similar strategies to increase knowledge and awareness about organ donation. Social media platforms can also be utilized as a means to educate and inform the public about the importance of organ donation.

4) This paper introduces two intervention techniques, staff training and the use of leaflets and posters, to support prompted choice in organ donation. To evaluate the feasibility, acceptability, and fidelity of these techniques, the researchers plan to utilize various methods including registration data, a training evaluation survey, focus groups with staff, and online surveys for both staff and participants.

5) The research paper introduces two distinct systems: the existing system and the proposed system.

The existing system enables donors to directly assist those in need with the approval of the administration. It also facilitates the collection of donations from various individuals and ensures their delivery to respective organizations. To maintain transparency, the system shares relevant information with doctors or professionals associated with the organizations.

In contrast, the proposed system aims to consolidate all essential donations for individuals in need within a centralized portal. It not only facilitates contributions to needy organizations but also ensures transparency by providing information to the volunteers affiliated with those organizations.

The research paper presents these two systems as different approaches. The existing system emphasizes direct donor assistance and transparent donation management, while the proposed system focuses on consolidating essential donations and providing aid through a centralized portal while maintaining transparency through volunteer involvement.

III. PROPOSED BLOCKCHAIN-BASED SOLUTION FOR ORGAN DONATION

We focus on establishing a secure process for organ donation using a distributed platform. The proposed approach involves a website operated by hospitals, connecting organ donors with recipients. To ensure data accuracy and organ identification, smart contracts will be utilized, preventing external interference. These smart contracts will be implemented on the Ethereum blockchain, a distributed computing platform. Patient information and transaction data will be stored in a smart contract uploaded to the blockchain.

Participants with authorized access will be able to utilize specific functionalities within each smart contract. They can view data stored on the blockchain, and examine transactions, logs, and events. The organ donation smart contract handles tasks such as creating a waiting list, acknowledging donors after clinical trial endorsement, and automatically matching donors with recipients. The organ transplantation smart contract manages the entire transfer process, including organ retrieval, transportation, and implantation. All previous steps are recorded and stored for future reference.

Private blockchains offer increased security and privacy as they limit access to authorized entities, unlike public blockchains. To enhance privacy and confidentiality, organizations can leverage the Ethereum blockchain to create their private-permissioned blockchain. This is particularly suitable for applications involving sensitive information, such as donor organ transfers, which often involve confidential patient medical records and genetic data.

The proposed solution heavily relies on the blockchain network as its foundation. Its primary purpose is to securely record transactions and events, ensuring accountability and maintaining the integrity of data. To ensure continuous accessibility, the smart contracts developed for the solution need to be deployed on the blockchain. However, during the testing phase, it is recommended to use a local blockchain environment, a virtual machine like the JavaScript-based Virtual Machine, or a test network instead of the main network. This allows for thorough testing of the Ethereumbased smart contracts. The REMIX IDE is used for developing these smart contracts, and they are deployed on Web3, which runs an isolated Ethereum node within the browser for convenient testing. Once the smart contracts are thoroughly tested and verified, they can be deployed on the Ethereum mainnet to evaluate their performance in a real blockchain environment. Importantly, the functions of the smart contracts are deterministic, meaning that regardless of the node executing the operation, the outcome will always be the same.

IV. IMPLEMENTATION DETAILS

The organ donation smart contract involves the participation of four key entities: the patient's doctor, a member of the clinic
relocation team, a procurement coordinator, and a matching coordinator. Each participant can interact with the smart contract by invoking its functions using their unique Ethereum addresses. The smart contract utilizes specific variables, including Ethereum addresses assigned to entities such as the procurement coordinator and the matching coordinator, to establish distinct connections. Another variable type is scheduling, which associates an entity's Ethereum address with a Boolean value to indicate specific requirements for that address.

The procurement coordinator is responsible for implementing the smart contract for organ donation. They deploy the smart contract and assume ownership, enabling them to provide the Ethereum address of the matching coordinator. The medical team member, who has the necessary authorization, conducts the test and declares its approval. Once the donor registration process is complete, the procurement coordinator announces the type of organ being donated. Following the completion of the automated matching process, the data of matched patients with potential donors is stored securely.

Algorithm 1: Adding a New Patient

Input: Patient_ID, Patient_Age, Patient_BMI, Bloodtype_, OrganType_

1. Patient_ID represents the unique identification number of the patient on the waiting list.
2. Patient_Age represents the age of the patient on the waiting list.
3. Patient_BMI represents the body mass index of the patient.
4. Bloodtype_ is a specific variable that denotes the blood type of the patient.
5. OrganType_ is a specific variable that indicates the type of organ needed by the patient.

Output: An event indicating the successful addition of a new patient to the waiting list.

6. assignedDoctorsToAddPatients_list: A mapping of the patients' doctors' Ethereum addresses.
7. If the caller is the ProcurementOrganizer:
8. Assign the value of true to assigningDoctor_list[PatientDoctor].
9. Else:
10. Revert the transaction.
11. /* The list of assigned patients' doctors is now updated */
12. If the caller is the PatientDoctor:
13. Set Patient_ID to the value of PatientsID[i].
14. Set OrganType_ to the value of NeededOrganType[i].
15. Set Patient_Age to the value of Patients_age[i].
16. Set Bloodtype_ to the value of Blood_type[i].
17. Set Patient_BMI to the value of BMI[i].
18. Else:
19. Revert the transaction.
20. End of the algorithm

Algorithm 2: Donor Medical Test and Registration

Input: Donor_ID, DonatedOrganType

1. Donor_ID represents the unique identification number of the organ donor.
2. DonatedOrganType is a specific variable that denotes the type of organ being donated.

Output: An event indicating the successful registration and approval of the organ donor.

3. assignedTransplantMembers_list: A mapping of the transplant team members' Ethereum addresses.
4. If the caller is the ProcurementOrganizer:
5. Assign the value of true to assigningmember_list[TransplantTeamMember].
6. Else:
7. Revert the transaction.
8. /* The list of assigned transplant team members is now updated */
9. If the caller is present in the assignedTransplantMembers_list:
10. Emit an event indicating that the donor has been medically approved for organ donation.
11. Else:
12. Revert the transaction.
13. /* Medical test approval has been completed */
14. If the caller is the ProcurementOrganizer:
15. Emit an event announcing that the donor has been successfully registered.
16. Else:
17. Revert the transaction.
18. End of the algorithm.

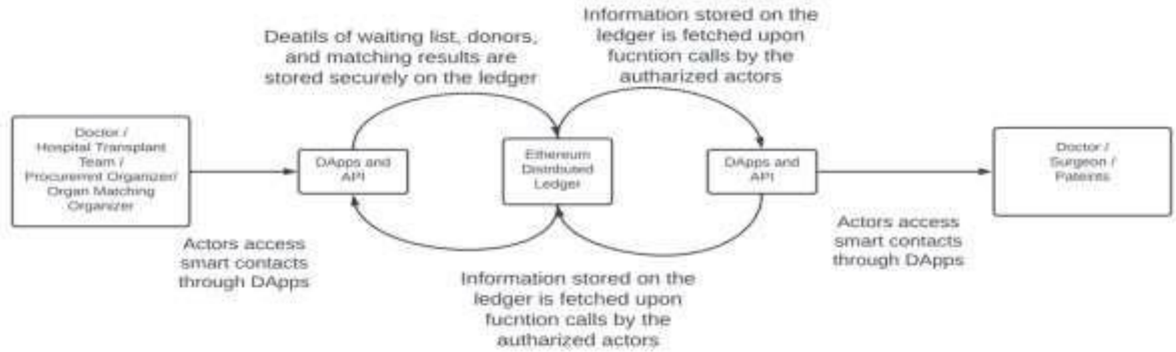
Algorithm 3: Matching Process

Input: Min_Age, Max_Age, Donor_BloodType, Donor_MinBMI, Donor_MaxBMI, _OrganType_

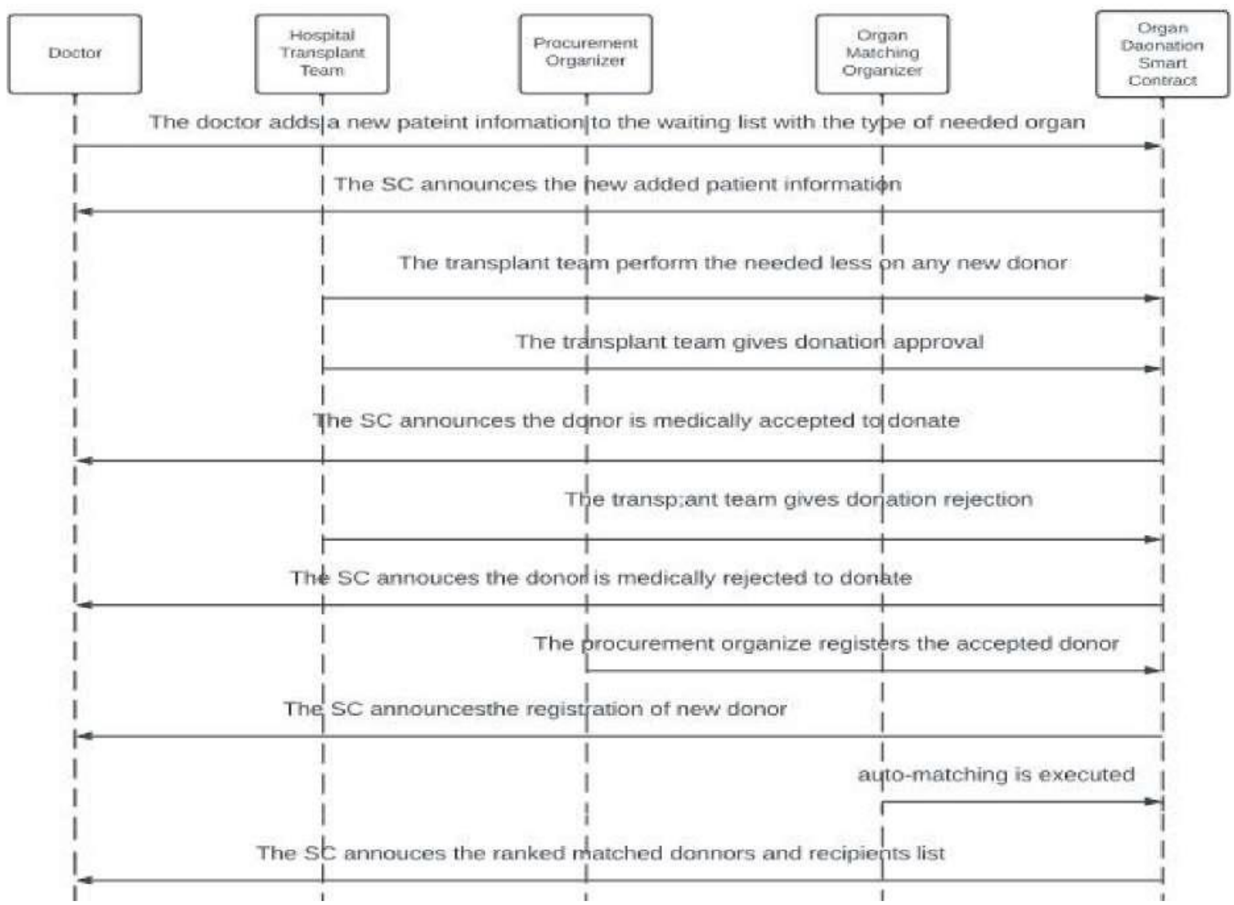
1. Min_Age represents the minimum acceptable age for matching with the donor's age.
2. Max_Age represents the maximum acceptable age for matching with the donor's age.
3. Donor_BloodType denotes the blood type of the donor.
4. Donor_MinBMI indicates the minimum acceptable body mass index for matching with the donor's BMI.
5. Donor_MaxBMI indicates the maximum acceptable body mass index for matching with the donor's BMI.
6. _OrganType_ is a specific variable representing the needed organ.

Output: A list of matched patients who meet the specified criteria.

7. If the caller is the OrganMatchingOrganizer:
8. For each patient 'i' in the Patients list:
9. Check if the Needed Organ Type of patient i is equal to _OrganType_ AND
10. (Patients_age[i] > Min_Age) AND
11. (Patients_age[i] < Max_Age) AND
12. (Blood_type[i] == Donor_BloodType) AND
13. (BMI[i] > Donor_MinBMI) AND 14. (BMI[i] < Donor_MaxBMI), then
15. Add patient i to the Matched list.
16. End of the loop.
17. Emit an event indicating the new matched organ.
18. End the function and return the matched organ list.
19. Revert the transaction.
20. End of the algorithm.



DESIGN



IMPLEMENTATION FLOW **IMPLEMENTATION FLOW**

V. RESULTS AND ANALYSIS

The integration of blockchain technology in the Organ Donation System enhances the confidentiality of donors during their contributions. This is achieved because blockchain transactions are inherently transparent.

In the system, hospitals have the ability to reserve an organ for a patient who is critically ill and whose family has expressed willingness to donate. When a patient passes away, their organs become available for a limited time and need to be transplanted promptly.

To record the organ donation process, essential information such as the patient's name, organ description, blood group, and current condition of the organ must be inputted and stored in the blockchain. It is crucial to continuously track the organ and receive updates on its status. Timely and secure transmission is essential, as any delay may render the organ unsuitable for transplantation. The migration files related to the process are stored in the designated migration directory.

VI.CONCLUSION

The study emphasizes the importance of maintaining a delicate and regularly updated procedure without outside interference. To achieve security and synchronization, the researchers utilized a decentralized platform, blockchain technology, and smart contracts. A comparison is made with other existing blockchain-based solutions, highlighting the adaptability of their approach for similar systems. They propose the development of an end-to-end App to further enhance their solution in the future. Additionally, they suggest utilizing a private Ethereum network for deploying and testing smart contracts. Lastly, they mention that the Quorum platform provides stronger confidentiality, as transactions can only be observed by specific participants, unlike their system where permitted players in the private blockchain can view transactions between participants.

VII.REFERENCES

[1] Kulshrestha, A., Mitra, A., & Amisha. (2020). Securing Organ Donation using Blockchain. International Journal of Scientific & Engineering Research, 11(6), June 2020.

[2] Douville, F., Godin, G., & Vézina-Im, L. A systematic review of interventions targeting health professionals and their impact on organ and tissue donation in clinical settings. This study is available under PMID: 24628967, PMCID: PMC4003858, and DOI: 10.1186/2047-1440-3-8.

[3] Abbasi, M., Kiani, M., Ahmadi, M., & Salehi, B. Perspectives on Knowledge and Ethical Issues in Organ Transplantation and Organ Donation from Iranian Health Personnel. The authors of this study are Mahmou Abbasi, Mehrzad Kiani, Mehdi Ahmadi, and Bahare Salehi.

[4] Jones, C. P., Papadopoulos, C., Randhawa, G., & Asghar, Z. A research protocol titled "General Practice Organ Donation Intervention - A Feasibility Study" (GPOD) by Catrin Pedder Jones, Chris Papadopoulos, Gurch Randhawa, and Zeeshan Asghar.

[5] Kalpana, K., & Baby Shamili, M. Organ Donor Management System. This system was developed by K. Kalpana and M. Baby Shamili, who are students pursuing their Master of Computer Applications at Madanapalle Institute of Technology And Science in Madanapalle, India.

[6] Network policies regarding organ donation and transplantation were published on October 31, 2019, and can be accessed at the following website: https://optn.transplant.hrsa.gov/

[7] Statistics on organ donation can be found at https://www.organdonor.gov/statistics-stories/statistics.html. The statistics were published on October 31, 2019.

[8] The "Blood Gift" framework was developed by the Foundation of Data Innovation, Software Engineering, and Designing branch at Jahangirnagar College in Dhaka, Bangladesh. It is discussed in Volume 4 of their publication.

[9] The "UNet" technology is available at unos.org/technology/unet. This information is from October 31, 2019.

[10] An article titled "Expert Attributes of the Transfer Facilitator" was published in the journal Transplantation Procedures, volume 29, pages 1607-1613, by Elsevier Science Inc. in 1997. It can be found on the NCBI website.