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ORGAN DONATION AND TRANSPLANTATION MANAGEMENT USING BLOCKCHAIN ETHERUM

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ABSTRACT:

Different requirements and obstacles arise in today's organ donation and transplantation systems for registration, donor-recipient matching, organ removal, organ delivery, and transplantation, along with technical, clinical, ethical, and legal limitations. As a result, a comprehensive system for organ donation and transplantation is necessary to ensure a just and effective procedure that improves patient satisfaction and trust. Our proposal is to utilize a private Ethereum block chain to facilitate the management of organ donation and transplantation in a way that is secure, private, auditable, traceable, and totally decentralized. We create smart contracts and give six algorithms, including information on how they are tested, validated, and put into practice. By conducting studies of secrecy, security, and privacy and contrasting our solution with the ones that already exist, we assess the effectiveness of the suggested solution.

Keywords*:*Privacy, organ donation, transplantation, block chain.

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I INTRODUCTION

Illness or trauma can cause organ damage or malfunction. In certain instances, it results in death and lowers quality of life. As organ transplants save the lives of patients, organ donation is one of humanity's most noble endeavors. Donor-recipient matching and suitable functioning conditions of the organ are necessary for a successful transplant; moreover, the organ's removal shouldn't endanger the donor's life. A kidney transplant involving twin brothers took place in 1954, marking the first successful organ donation. Transplants performed each year have risen steadily since then.

There are still more recipients of organs than there are donors, despite this. Twenty individuals really pass away each day while waiting for an organ transplant, and every day a new patient is in. More significantly, obtaining a spot on the organ donor waiting list is a prerequisite for organ distribution. Geographical and socioeconomic characteristics might have an impact on transplant referrals. As a result, no patient group should be treated unfairly throughout the waiting list allocation procedure.

There are two methods for donating organs: live donation and donation from the deceased. The transplant staff at the hospital examines the donor first, and if the donor is dead, a brain death test is carried out. In the interim, medical professionals assess the donor, if they are still alive, to make sure they are suitable for a live donation.

In order to determine whether the donor is a suitable candidate for donation, the procurement organizer must assess the donor's health and make sure the donor is correctly registered in the healthcare system. The organ transplantation organizer receives all the information from the procurement organizer if the evaluation indicates that the donor is qualified for donation. Only with the donor's permission may this step be carried out in order to gift to an anonymous recipient. The organ transplant coordinator then arranges for the pairing of patients on the waiting list with available donors.

The transplant surgeons receive an output in the form of a ranked list as a result. Subsequently, the transplant surgeon determines if the organ is suitable for the patient by taking into account multiple factors, including the prospective recipient's present condition and the donor's medical history. The donor's surgeon is notified to remove the given organ when a transplant surgeon accepts it. Ultimately, the transplant surgeon receives the donated organ once it has been delivered to the patient’s hospital.

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Let's say, however, that the circumstance calls for a live donor and that the intended recipient is a specific individual. In that instance, the transplant surgeon will receive the data directly and begin the process of rem

In the past, the hospital and organ procurement organization collaborated to do an initial medical examination to determine whether a patient may be an organ donor when the patient passed away or was close to passing away. It takes about fifteen minutes to complete this call, and only six percent of them lead to the identification of potential organ donors. Over time, an instant message produced by central computer systems that retain all the necessary data for this process has taken the role of this phone conversation.

II. LITERATURE SURVEY

1.According to L A Dajim proposed that [1] The suggested system is a block chain-based decentralized software for organ donation. It would be a website where patients might register their information, including their medical ID, blood type, organ type, and state. Unless a patient is in severe condition, the system would operate on a first in, first-out basis.

2.A Powell [2] suggested that Organ donation and transplantation systems have unique needs and obstacles in terms of registration, donor-recipient matching, organ removal, organ delivery, and transplantation, all of which are hampered by legal, clinical, ethical, and technical restrictions. To improve patient experience and confidence, end-to-end organ donation and transplantation platforms are essential to ensure a fair and efficient procedure. We offer a private Ethereal block chain-based system for managing organ donation and transplantation in a completely decentralized, secure, traceable, auditable, private, and trustworthy manner. We create smart Contracts and three web-based modules for detail validation

3) 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.

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III SYSTEM ANALYSIS

EXISTING SYSTEM

Transnet is a system that helps with the labeling, packaging, and tracking of organs and other biological materials for transplantation by using barcode scanning technology at the organ recovery point.

Kinder, a block chain-based kidney donation platform, has been suggested. Rather than using the existing kidney waiting list, it offers a kidney-pair donation module.

Limitations of Existing system

- The system is not implemented block chain based organ donation which leads less security and less communication between hospitals and donors.
- The system is not implemented an auto-matching process between the donor and recipient through a smart contract based on certain criteria.

PROPOSED SYSTEM

The system offers a private Ethereum block chain-based solution that guarantees the decentralized, secure, dependable, traceable, auditable, and trustworthy administration of organ donation and transplantation.by creating events for each step required to complete the organ donation and transplantation process, the system creates smart contracts that register actors and guarantee data provenance. A smart contract is used by the system to create an auto-matching procedure between the donor and beneficiary based on predetermined parameters. Six algorithms are presented by the system, complete with implementation, testing, and validation details. In order to ascertain whether the suggested solution is safe from frequent security threats and weaknesses, the system performs security analysis.

Proposed system Advantages:

- We assess the performance of the suggested solution by conducting privacy, security, and confidentiality assessments and comparing it to current solutions.
- This platform optimizes pre-transplantation tasks, potentially increasing process efficiency.

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IV IMPLEMENTATION

Architecture:

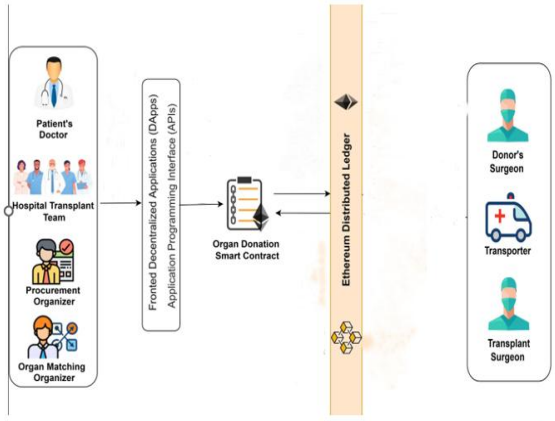

Fig-1. Architectures of the system model

This section contains the algorithms and implementation details for our suggested block chain-based organ donation and transplantation solution. Validation nodes and authorized participants are added to a private Ethereum block chain, which serves as the foundation for the suggested system.

The Remix IDE, an open-source online tool for creating and managing smart contracts, is used to test the Solidity-written smart contracts. Organ donation and transplantation are the two main ways that our suggested solution will be put into practice. The descriptions of each one's specifics are given below.

Organ Supplement the hospital transplant team, procurement organizers, matching organizers, and the patient's physician are the four parties that take part in the organ donation smart contract. Every participant has an Ethereum address and can call the smart contract's services to get involved. There are several distinct kinds of variables in this smart contract. The Ethereum address is one of the variables; it is used to link specific entities, like the procurement organizer and the matching organizer, to a specific address. The second kind is mapping; in our solution, this associates an entity's Ethereum address with a Boolean to indicate that the address requires specific requirements. For instance, mapping is utilized by licensed physicians and transplant surgeons. Additionally, mapping is employed to guarantee patient selection for patient validity.

Furthermore, there is an enumerating variable called "Blood type," which includes the various blood types, such as "A," "B," "AB," and "O." This variable takes uint8 input, where the blood types are represented

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by the values "0," "1," "2," and "3," respectively. Furthermore, uint8 input is accepted via the enumerated variable "Organ Type," where "0" denotes "Heart." "1" stands for "Lung," "Liver" is represented by "2," and "kidney" is represented by "3." The organ donation smart contract will be implemented by the procurement organizer. By deploying the smart contract and taking ownership, the procurement organizer enables this participant to choose the Ethereum address of the corresponding organizer. A new patient is then added by the approved physician to the waiting list, and everyone involved is informed.

The authorized member of the medical team then conducts the test and declares that it has been approved. The procurement organizer then completes and announces the donor registration process, including the kind of donated organ. Subsequently, the auto-matching procedure is carried out, and the data pertaining to patients who match with possible donors is archived. Lastly, the primary factors that determine this procedure are age, blood type, BMI, and waiting duration.

MODULES

1. Donor Module
2. Patients Module
3. Hospital Module

1. Donor Module:

In this module, the Donor will register and login then uploads their organ donor data to the Hospital and will do the following operations such as View Profile, Send Organ Donating Details, and View Organ Donated Details Status.

2. Patient Module

In this module, patients log in by using his/her username and password. After Login User will do some operations such as My Profile, Register for Organ Transplantation, View All Organ Transplantation Details.

3. Hospital Module

The hospital also carries out the following procedures in addition to maintaining hospital records and offering organ preservation services for donation and transplantation: View every patient and provide permission. See all contributors and grant permission. Include the organ kind. See Every Block chain Organ Name Hash Code Here View All Information Donated,

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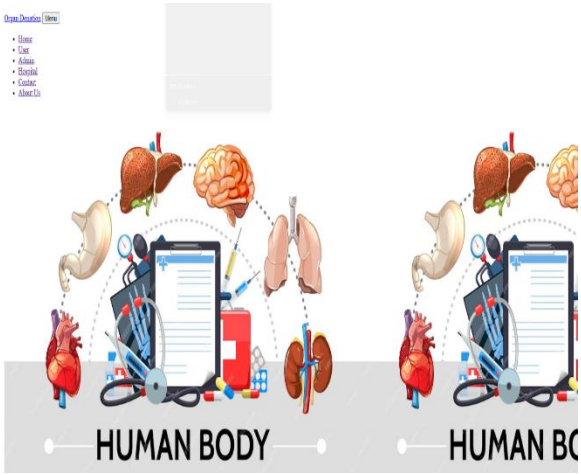
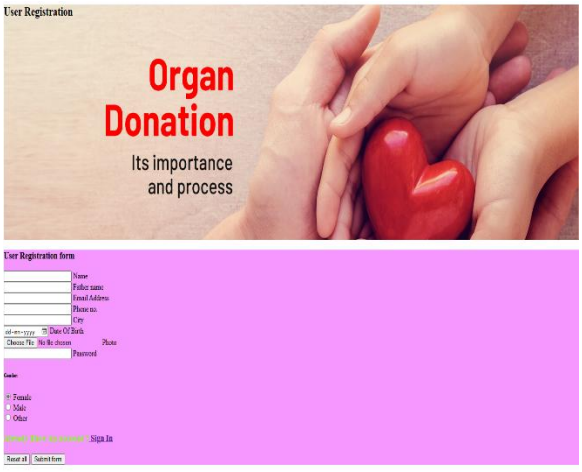
View All Information Requested by Patients for Transplantation, View All Information Donated Through Block chain, See all info on organ transplantation by block chain. See Results for All Organ Donations. View the Results of Organ Transplantation.

V RESULT AND DISCUSSION

Home page:

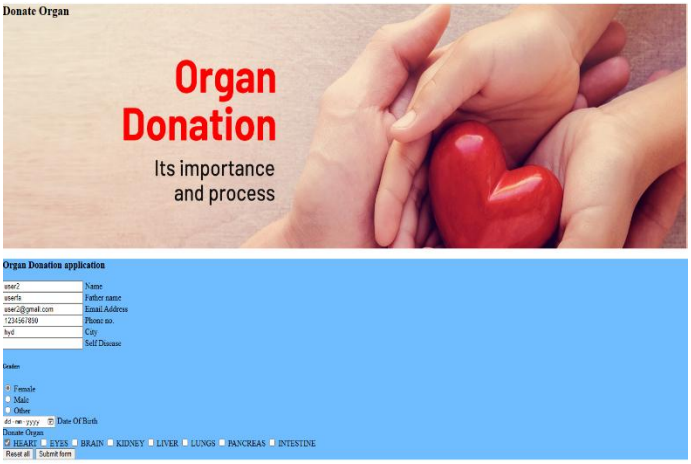


User register page:

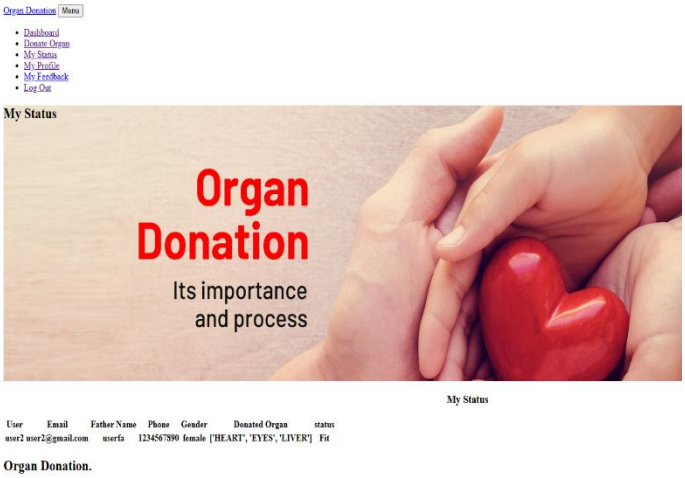


User login page:

User submit Page:



Check the status:



Admin login page:

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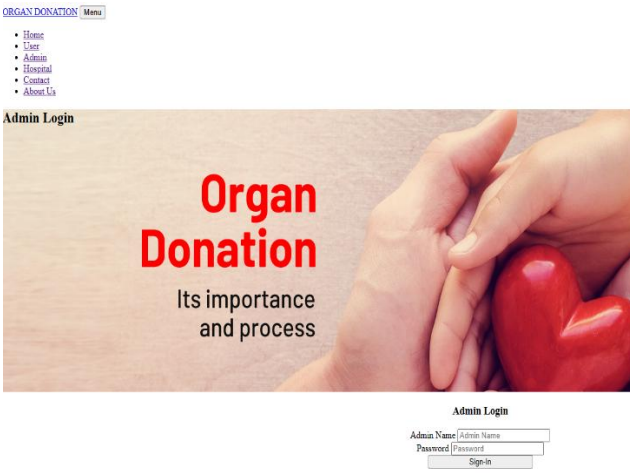
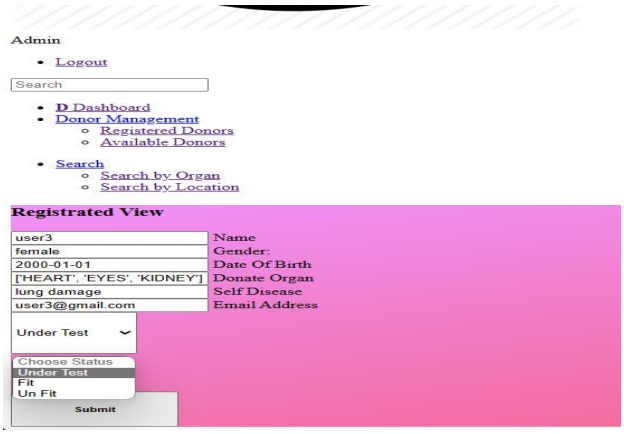
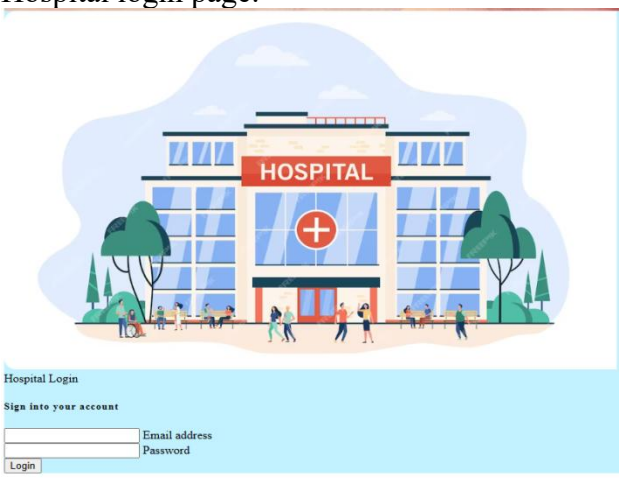


Admin checks the registered users, pending users: And checks the organ donors and status. And issue the death certificates Page:

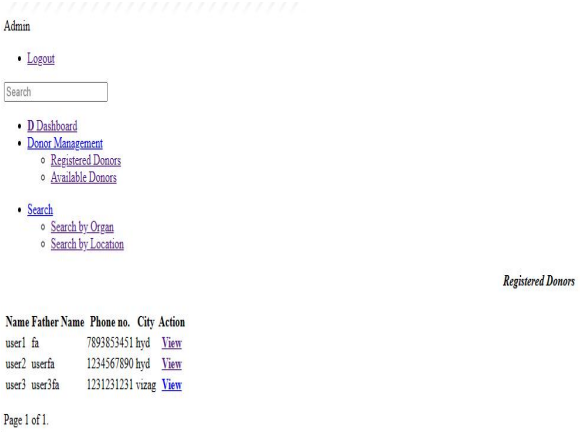
Admin update the status of donor, if he is fit, unfit, under test for further process:



Hospital login page:



Authorized person in hospital can check registered and available donors:



VI CONCLUSION

We have proposed a private Ethereum block chain-based solution that manages organ donation and transplantation in a decentralized, accountable, auditable, traceable, secure, and trustworthy manner. We developed smart contracts that ensure the data provenance by recording events automatically. We analyze the security of the proposed solution to guarantee that smart contracts are protected against common

attacks and vulnerabilities. We compare our solution to other block chain-based solutions that are currently available. We discuss how our solution can be customized with minimal effort to meet the needs of other systems experiencing similar problems. In the future, our solution can be improved by developing an end-to end Dap. Furthermore, the smart contracts can be deployed and tested on a real private Ethereum network. Finally, the Quorum platform can provide better confidentiality because transactions among entities can only be viewed by specific participants and nobody else, which is not the case in our solution, where transactions between two participants are viewed by other actors authorized in the private block chain.

FUTURE ENHANCEMENT

The adoption of block chain technology in organ donation and transplantation presents numerous advantages. The transparent and tamper-proof nature of the block chain ledger ensures that all relevant stakeholders have access to the same trustworthy data, reducing information asymmetry and fostering collaboration. This transparency also helps in tracking the journey of organs, addressing concerns related to organ provenance and accountability. Additionally, the use of smart contracts streamlines processes and reduces administrative burden, which can lead to quicker organ allocation and transplantation, ultimately saving lives.

While the potential benefits are significant, challenges need to be addressed. The integration of block chain with existing healthcare systems can be complex and require careful planning to ensure interoperability. Concerns about data privacy and security must also be addressed, as sensitive patient information is being shared among various stakeholders. Additionally, the scalability of block chain networks and the associated energy consumption need to be carefully managed, especially in large-scale healthcare systems. Implementing a block chain-based system introduces ethical considerations, such as patient consent, data ownership, and the potential for unintended consequences. The use of anonym zed data for research purposes, while valuable, should be balanced with ethical considerations regarding patient privacy and informed consent.

To successfully implement the proposed solution, a collaborative approach involving medical professionals, regulatory bodies, patients, and technology experts is

necessary. Stakeholder engagement is crucial for defining standards, protocols, and best practices that ensure the effective functioning of the block chain-based management system.

The proposed system presents a foundation for future research and development in the field of organ transplantation and healthcare management. Exploring more advanced consensus mechanisms, addressing scalability concerns, and investigating the integration of emerging technologies like artificial intelligence could further enhance the capabilities of the proposed solution.

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