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Management of Organ Donation and Transplantation Using Blockchain

[1] **Dr. K. SAILAJA** MCA,M.Tech ,M.Phil,Ph.D
[1]Professor&HOD
[1]Department of Compter Applications
[1]Chadalawada Ramanamma Enginnering college

[2] **GOSWAMY SARATH KUMAR**
[2] Student
[2] Department of Computer Applications
[2]Chadalawada Ramanamma Engineering college

ABSTRACT_ Organ donation and transplantation systems now face a variety of requirements 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 constraints. As a result, a comprehensive organ donation and transplantation system is essential to provide a fair and efficient process that improves patient experience and trust. We offer a private Ethereum blockchain-based solution for organ donation and transplantation administration that is fully decentralised, safe, traceable, auditable, private, and trustworthy in this article. We create smart contracts and offer six algorithms, along with details on their implementation, testing, and validation. We assess the performance of the suggested solution by conducting privacy, security, and confidentiality assessments and comparing it to existing solutions.

1.INTRODUCTION

An injury or disease can cause organ damage or failure. It has an impact on quality of life and, in some instances, causes death. One of humanity's most selfless acts to save patients' lives through organ transplantation is to donate an organ. With donor-recipient matching, the organ must be in acceptable working condition for a successful transplant, and its removal should not pose a risk to the donor's life [1]. In 1954, a kidney was successfully transplanted from one brother to the other by twin brothers [2]. The annual number of transplants has steadily grown since then. However, there is still a greater demand for organ donations than there are donors [3]. Twenty people die each day while waiting for an organ transplant, and a new patient is added to the waiting list every

ten minutes [4]. More importantly, obtaining access to the waiting list for organ donation is a fundamental prerequisite for organ allocation. Geographical and socioeconomic factors both have an impact on transplant referrals. As a result, certain patient groups should not be discriminated against in the waiting list allocation process [4] There are two ways to donate organs: from a deceased person and from a living person. The typical flow chart for donating an organ and transplanting it to a patient is shown in Figure 1. The hospital transplant team first examines the donor, and if the donor has passed away, a brain death test is carried out. In the meantime, if the donor is still alive, they are examined to determine whether they are suitable for live donation. The procurement organizer is then informed of each and every medical record. It is the responsibility of the procurement organizer to evaluate the donor's condition to determine whether he is a suitable donor and to ensure that the donor is properly registered with the medical system. The procurement organizer then transmits all of the information to the organ transplantation organizer if the evaluation reveals that the donor is eligible for donation. Only if the donor consents to the donation being made to an anonymous recipient can this step be carried out. The organ transplantation organizer then conducts the matching procedure between patients on the waiting list and donors who are available. As a result, a ranked list is made and given to transplant surgeons as an output. After that, the transplant surgeon looks at a number of factors, like the donor's medical records and the patient's current health, to determine whether or not the organ is suitable for the patient. When a transplant surgeon accepts the donated organ later, the donor's surgeon is informed that the organ must be removed. At last, the gave organ is moved to the patient's clinic and gotten by the transfer specialist. However, suppose that the situation calls for a live donor and that it has been planned to donate to a named individual who is known to the donor. If that is the case, the information will be sent directly to the transplant surgeon, who will then begin the procedure of removing the donated organ and transplanting it [6, 7].

2.LITERATURE SURVEY

2.1 L. A. Dajim, S. A. Al-Farras, B. S. Al-Shahrani, A. A. Al-Zuraib, and R. Merlin Mathew, ``Organ donation decentralized application using blockchain technology,'' in Proc. 2nd Int. Conf. Comput. Appl. Inf. Secur. (ICCAIS), May 2019, pp. 14, doi: 10.1109/cais.2019.8769459.

The medical field has been completely transformed by organ donations. Numerous people are willing to donate organs, whether they are alive, deceased, or even brain-dead. The main problem with organ donation is that many factors delay the supply of the organ, which means that many patients who need an organ don't survive. We target settling this

issue utilizing blockchain which is a circulated data set and can powerfully oversee such information bases. It provides the participant with a concise summary of the entire procedure. The data that has been entered will be stored in blocks, which will make the process easier. Additionally, the use of blockchain will ensure that no block can be falsified or that any information can be accessed illegally, making all transactions extremely secure. We also intend to implement a weight-checking system for the container in which the organ will be stored to ensure its physical safety. The administration will be notified and notified automatically if this system records any change in the container's weight.

2.2 EACMS: Emergency access control management system for personal health record based on blockchain Authors: Rajput, Ahmed Raza, Qianmu Li, MiladTalebyAhvanooey, and IsmaMasood.

Create an emergency access control management system (EACMS) using hyperledger composer and hyperledger fabric, both of which are permissioned blockchain components. Using smart contracts, we defined some rules for the emergency condition and time period for emergency access PHR data items in the proposed system. Patients can assign limits to control PHR permissions. Based on response time, privacy, security, and accessibility, we analyzed the performance of our proposed framework by implementing it through the hyperledger composer. In the PHR framework, the patient presented the crisis contact for the crisis condition in light of the fact that the patient is oblivious and unfit to allow his PHR access. If the EMT staff needs to get in touch with the emergency contact person in the PHR and the emergency contact person does not respond promptly or at all, or if there is some other issue with the emergency contact person, what will the EMT staff do in the event of an emergency? Consent management and data fetching are both complicated and inconvenient. The patient after fix can follow the current data in a PHR framework that assuming any specialist previously entered with the consent of crisis contact individual sake of the patient, there is no any record to show the following. Our solution uses permissioned blockchain technology to grant ED access, accelerating consent management and the retrieval of PHR data from the PHR system. We created a smart contract that makes it simple for a patient to set permission access control policies for his or her data and allows dynamic PHR data to be shared with the emergency department in times of need.

3.PROPOSED SYSTEM

The system proposes a private Ethereum blockchain-based solution for managing organ donation and transplantation in a decentralised, secure, reliable, traceable, auditable, and trustworthy manner.

The system creates smart contracts that register actors and assure data provenance by establishing events for all of the actions required during the organ donation and transplantation stages. The code for smart contracts is freely available on Github.1

Based on particular characteristics, the system creates an auto-matching process between the donor and the beneficiary via a smart contract.

Six algorithms are presented, together with detailed implementation, testing, and validation details.

The system does a security analysis to ensure that the suggested solution is safe from common security threats and weaknesses. To demonstrate the originality of our solution, we compare it to existing solutions. Our proposed solution is generic and may be simply tailored to fit the requirements of a wide range of related applications.

3.1 IMPLEMENTTAION

- **Donors**

  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, View Organ Donated Details Status.

- **Patients**

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

- **Hospital**

The Hospital manages Hospital records to provide organ storage service for donation and transplantation and also performs the following operations such as View all Patients and Authorize, View all Donors and Authorize,Add Organ Type, View All Blockchain Hash Code for Organ Names,View All Organ Donated Details,View All Patient Transplantation Requested Details,View All Organ Donated Details By Blockchain,View All Organ Transplantation Details By Blockchain, View All Organ Donation Results,View Organ Transplantation Results.

4.RESULTS AND DISCUSION

5.CONCLUSION

In this work, we offer a private Ethereum blockchain-based solution for managing organ donation and transplantation in a way that is decentralised, responsible, auditable, traceable, secure, and trustworthy. We created smart contracts that automatically record events to assure

data provenance. Six algorithms are presented, together with details on their implementation, testing, and validation. We examine the suggested solution's security to ensure that smart contracts are safe from common attacks and flaws. We compare our solution to other blockchain-based alternatives already on the market. We discuss how our solution can be easily customised to meet the demands of other systems suffering similar issues. In the future, we can improve our solution by creating an end-to-end DApp. Smart contracts can also be deployed and evaluated on a genuine private Ethereum network. Finally, the Quorum platform can provide greater confidentiality because transactions between entities can only be viewed by specific participants and no one else, whereas in our solution, transactions between two participants can be viewed by other actors authorised in the private blockchain.

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