MANAGEMENT OF ORGAN TRANSPLANTATION USING BLOCK CHAIN

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Abstract
Organ donation and transplantation systems pose different requirements and challenges in terms of registration, donor-recipient matching, organ removal, organ delivery, and transplantation with legal, clinical, ethical, and technical constraints. End-to-end organ donation and transplantation systems are required to guarantee a fair and efficient process to enhance patient experience and trust. We propose a private Ethereum blockchain-based solution to enable organ donation and transplantation management in a manner that is fully decentralized, secure, traceable, auditable, private, and trustworthy. We develop smart contracts and three modules on the web page for validation of details. We evaluate the performance of the proposed solution by performing privacy, security, and confidentiality analyses as well as comparing our solution with the existing system.
Keywords: Organ donation, transplantation, Blockchain, Ethereum, Decentralized.

1.Introduction
Organ failure or damage occurs due to an injury or a disease. It affects the quality of life and, in some cases, leads to death. Donating an organ is one of humanity's most honorable actions to save the lives of patients through organ transplantation. For a successful transplant, the organ must be in acceptable working conditions with donor-recipient matching, and its removal should not pose a life-threatening risk to the donor. The first successful organ donation occurred with a kidney transplant between twin brothers in 1954. Since then, the annual number of transplants has steadily increased. However, the demand for organ donations still exceeds the number of donors. In fact, while waiting for an organ transplant, twenty people die every day, and a new patient is added to the waiting list in every ten minutes. More importantly, accessing the organ donation waiting list is a basic requirement for organ allocation. Referral for transplantation can be affected by both geographical and socioeconomic factors. Therefore, the allocation process on the waiting list should not discriminate against certain groups of patients.Organ donation is conducted in two different ways, including deceased donation and living donation. Figure 1 illustrates the typical flow chart for donating an organ and transplanting it to a patient. First, the donor is examined by the hospital transplant team, and if the donor is deceased, a brain death test is performed. Meanwhile, if the donor is still alive, doctors examine the donor and ensure that the donor is fit for live donation. Then, all medical records are reported to the procurement organizer. The procurement organizer is responsible for evaluating the donor's condition to decide if he is a fit donor and ensuring that the donor is properly registered in the medical system. Next, if the evaluation shows that the donor is eligible for donation, the procurement organizer sends all the data to the organ transplantation organizer. This step can be performed only if the donor gives consent to donate to an anonymous person. After that, the matching process between the available donors and patients on the waiting list is performed by the organ transplantation organizer. As a result, a ranked list is generated as an output and provided to the transplantation surgeons. Next, the transplant surgeon decides whether the organ is appropriate for the patient based on various considerations, such as the donor's medical records and the current health of the prospective recipient. Later, when a transplant surgeon accepts the donated organ, the donor's surgeon is notified to remove the donated organ. Finally, the donated organ is transported to the patient's hospital and received by the transplant surgeon. However, suppose the situation is for a live donor and it has been planned to donate to a known person by name. In that case, the data will

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go directly to the transplant surgeon to start the surgery of removing and transplanting the donated organ .

2.Literature Review

The following research papers were referred by us before doing our project. While referring to each of these papers we have come across various different findings discussed below.
Title: Creating Organ Donation System with Blockchain Technology
Author: Dr. S. Ganesh Kumar, Anmol soni
Title: Securing Organ Donation using Blockchain
Author: Anuradati Kulshrestha, Abhirupa Mitra, Amisha
Title: Blockchain-based management for organ donation and transplantation
Author:Diana hawashin,Raja Jayaraman, Khaled salah, Ibrar yaqoob, Samer Ellahham

3. Problem Definition

The main aim is to propose blockchain based solution to address the issues in organ donation and transplantation systems. Patients use to register their information, including their medical ID, organ type, blood type, and state. The system would operate on a first-in, first-out (FIFO) approach.It offered better security, added transparency, and a much faster system

4. Methodology

The multi-level software platform is one the application solutions for organ donation and translations which having third party issues in it.Using Blockchain based technique to the web application can improve the efficiency of the application and users. Different Block chain hash codes were generated to different modules and identities by using smart contracts. Various libraries were used such as servlet-api, .jsp which provides security and easy accessibility to users.

Creating Hash codes:

Hashing refers to the transformation and generation of input data of any length into a string of a fixed size, which is performed by a specific algorithm**.** The implementation of a cryptographic hash function is beneficial to prevent fraudulent transactions, double-spending in blockchain, and store passwords. This is a unique number that is not duplicable according to the algorithm. Therefore, it is frequently used to verify a file's authenticity. A hashing algorithm takes an infinite number of bits, performs calculations on them, and outputs a fixed number of bits. Regardless of the input data's length, the output will always be rectified. As a result, the original data is called input, and the final transformation is called a hash. Today, many hashing algorithms differ only in the way information is processed.
To fully comprehend what hashing is about, it's essential first to understand the data structure. A data structure is a specific way of storing data that consists of two key elements: pointers and linked lists. Pointers are variables referring to other variables, so they act as indicators that show the way to the right location. Besides, it provides the address of the next block in the chain. Linked lists, on the other hand, make up a sequence of the nodes that are connected with the help of pointers. Each block is assigned an original identifier, which will entail the irreversible consequences of changing the blockchain. The block is identified by information included in the header of the block. It consists of such details as:

- the version number of the blockchain
- UNIX timestamp
- hash pointers
- nonce, which is the value the miners need to create a block
- a hash of a Merkle root

All these elements are needed to create the block. So when a hash happens to the blockchain, the data will be converted into a unique string within a block.

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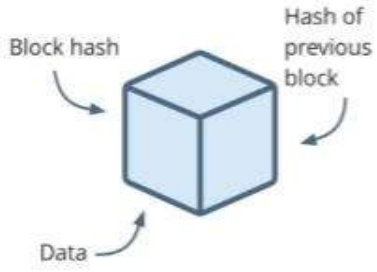

Figure 4.1: Formation of block

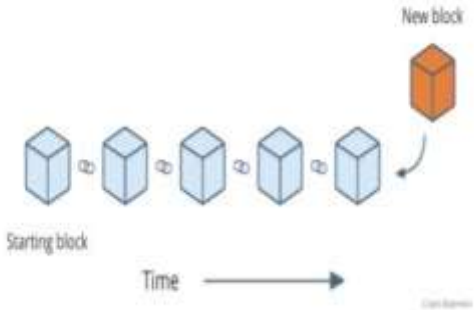

Figure 4.2: Adding blocks in chain series

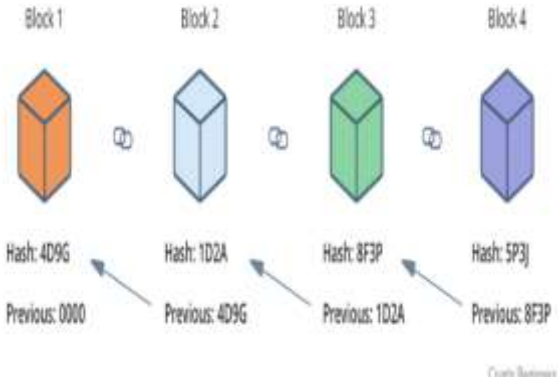

Figure 4.3: Block addition with hash numbers

Website creation:
we create a website which having three modules namely Hospital, donar, patient.
Hospital: It 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
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.

5. CONCLUSION
we have proposed a private Ethereum blockchain-based solution that manages organ donation and transplantation in a decentralized, accountable, auditable, traceable, secure, and trustworthy manner.

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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 blockchain-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.

6. FUTURE WORK:

In the future, our solution can be improved by developing an end-to-end DApp. 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 blockchain.

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