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AN APPLICATION FOR TRACKING ORGAN DONATION IN HOSPITALS USING BLOCKCHAIN

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ABSTRACT
Organ donation and transplantation systems today have varying demands and challenges regarding registration, donor-recipient matching, organ extraction, organ transport, and transplantation with legal, clinical, ethical, and technical limitations. Thus, an end-to-end organ donation and transplantation system is needed to ensure a fair and efficient process to improve patient experience and trust. In this paper, we suggest a private Ethereum blockchain-based solution to facilitate organ donation and transplantation management in a way that is completely decentralized, secure, traceable, auditable, private, and trustworthy. We design smart contracts and introduce six algorithms with their implementation, testing, and validation details. We assess the performance of the proposed solution by conducting privacy, security, and confidentiality analyses as well as comparing our solution with the current solutions. We make the smart contract code open-source on GitHub to share the project with others. This paper introduces a novel application using blockchain technology for tracing organ donation activities in hospitals. Organ transplantation is a life-saving process, but its efficiency is usually hampered by issues of lack of transparency, inconsistency of data, and inefficient communication among stakeholders. Utilizing blockchain, a decentralized and unalterable ledger, our application provides transparent and secure recording of organ donation-related information, such as donor data, availability of organs, transplant operations, and recipient data. Smart contracts automate and enforce pre-established rules and agreements, making the whole donation process efficient while ensuring data integrity and confidentiality. In addition, blockchain's decentralized nature obviates the necessity for intermediaries, cutting down on delays and guaranteeing real-time access to essential information by the authorized parties. Through a proof-of-concept implementation and simulation, we prove the viability and advantages of our suggested solution in improving the efficiency, transparency, and credibility. This paper introduces an innovative application based on blockchain technology for organ donation tracking and organ translation processes in hospitals with ease.

1.INTRODUCTION

Organ damage or failure results from a disease or an injury. It impacts the quality of life and, in certain instances, results in death. Organ donation is one of the most noble deeds of human beings to preserve the lives of patients by transplanting organs. For a transplant to be successful, the organ should be in good working condition with donor-recipient compatibility, and its extraction should not be life-threatening to the donor. The first organ transplant was a kidney transplant between twin brothers in 1954. The number of transplants has been steadily rising each year since. Yet, there are still more people in need of organ donations than there are donors. It is the duty of the procurement organizer to examine the condition of the donor in order to determine whether he is a suitable donor and that the donor is registered in the medical system. Secondly, if the assessment indicates that the donor is suitable for donation, the procurement organizer transmits all the information to the organ transplantation organizer. This can be done only if the donor agrees to donate to an unknown individual. Then, the matching between the available patients on the waiting list and available donors is done by the organ transplantation organizer. Consequently, a ranked list is created as an output and given to the transplantation surgeons. Then, the transplant surgeon makes a decision on whether the organ is suitable for the patient based on multiple factors, including the medical records of the donor and the current health status of the prospective recipient. Subsequently, when a transplant surgeon receives the donated organ, the donor's surgeon is called to

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take out the donated organ. Lastly, the donated organ is shipped to the patient's hospital and accepted by the transplant surgeon. But if the scenario is for a live donor and it has been arranged to donate to a familiar individual by name, then the information will be sent straight to the transplant surgeon to begin the operation of taking out and transplanting the organ. Previously, if a patient passed away or was in a dying state, the hospital and organ procurement organization collaborated to perform an initial medical screening to determine whether the patient could be an organ donor. It takes approximately 15 minutes to make this call, and only 6% of these calls lead to potential organ donors being identified. Throughout the years, this telephone call has been substituted by an instant message created by central computer systems that contain all the information needed for this process.

2. LITERATURE SURVEY

1. Organ donation decentralized application based on blockchain technology.The system described is an organ donation decentralized[12] app based on blockchain technology.It would be a web application to enable patients to register their data-most importantly medical ID, blood type, organ type and condition. The system would be on a first-in, first-out basis except for critical patients.
2. Application of blockchain technology in the organ procurement and transplant network.The organ donation system in the United States is centralized and difficult to audit by the general public. This centralized approach may lead to data integrity issues in the future. The Organ Procurement and Transplant Network (OPTN) was developed and sustained by a nongovernmental organization named the United Network for Organ Sharing (UNOS) under its proprietary UNet(SM) umbrella platform. This platform consists of proprietary closed source software and does not make the general public it easy to access organ transplant data for audit. This research explores the feasibility, drawbacks, and benefits of a blockchainbased OPTN.
3. Utilization of forensic DNA testing to follow unethical organ procurement and organ trafficking practices in countries that restrict open access to their transplant data.This research suggests a method to track unethically procured organs specifically in nationsor areas where investigations can't be carried out by means of forensic DNA technology.Referring to China as an example, prior studies have determined that organs in China are partly unethically and extra-legally obtained (so-called "forced organ harvesting") from alive prisoners of conscience without consent. Employing forensic DNA-analysis, we recommend creating a DNA data bank from missing prisoners of conscience in China and comparing these findings with DNA from donor organs in patients who received transplants in China. Biological samples obtained in China will supply DNA directly or indirectly from potential victims of forced organ harvesting. Transplant recipients' donor organs archival biopsies will supply donors' DNA profiles. Authentic match between missing victims' DNA profiles of transplanted organs and DNA profiles will establish evidence of such link, thus supplies evidence in spite of a lack of transparency. Employing forensic DNA-analysis, we suggest constructing a DNA data bank from missing prisoners of conscience in China and matching these findings with DNA from donor organs in patients who have undergone transplants in China.
4. Decentralised and distributed system for organ/tissue donation and transplantation.In the age of digitisation today, most technologies have been developed that all manual work can be digitally automatized. During the digital automatizing process, security and privacy are the most critical and very challenging factors. Blockchain provides numerous features which are applicable in nearly all areas of life. Features such as decentralisation, transparency, privacy makes it a very handy technology. Thus, leveraging all these features, various issues in healthcare field can be addressed such as elimination of complicated network of third parties and untraceability of transactions. This paper introduces a decentralised, secure and transparent organ and tissue transplant web application (also referred to as DApp), which not only eliminates the role of any third party in the organ transplantation, but also is an economical solution that saves the patient's from expensive cost of transplantation. The details and Electronic Medical Record(EMR) are hashed with the help of the IPFS(a distributed file server), which minimizes the cost of upload to a large extent as evident in the results section of this paper.

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5 .A systematic review of the application of blockchain in healthcare. Blockchain technology facilitates a distributed and decentralized system without requiring a central authority. Transactions are at once secure and reliable because of the implementation of cryptographic principles. Blockchain technology has been highly fashionable over the last few years and has entered various fields, primarily because cryptocurrencies have been so popular. One area where blockchain technology has such high potential in healthcare, considering the requirement for a more patient- centred model of healthcare systems and to integrate various systems and make electronic healthcare records (EHRs) more accurate. In this systematic review, an examination of cutting-edge blockchain studies in healthcare is undertaken. The purpose is to unveil the prospective applications of the technology and the challenges and potential directions of blockchain research in healthcare. Background information is presented first,then the precise methodology applied in this paper is described. An analysis of the results follows, including a bibliometric overview, an analysis of data collected and its characteristics, and the outcome of a literature quality assessment. Finally, there is a discussion of the results of the analysis. The results show that blockchain technology research in healthcare is on the rise and it is primarily utilized for data exchange, health records management and access control.

3.PROBLEM STATEMENT

The current model is utilized to forecast objects on An Application for Tracking Organ Donation in Hospitals Application of Blockchain for organ donation and transplantation management has been difficult owing to the absence of data accountability, immutability, audit, transparency, traceability, and trust features in the current systems. We suggest a private Ethereum blockchain-based solution that guarantees organ donation and transplantation management in a form that is decentralized, secure, reliable, traceable, auditable, and trustworthy.

4. PROPOSED SOLUTION

The proposed blockchain-based solution for donated organ transplantation seeks to address the short comings of the existing organ donation process by introducing comprehensive reforms aimed at improving efficiency, transparency, and security. The participants include doctors, hospital transplant team members, procurement organizers, organ matching organizers, a transporter and a transplant surgeon. The Organ Donation Smart Contract is responsible for creating a waiting list, accepting donors after medical test approval, and auto matching between the donor and recipient. The Organ Transplantation Smart Contract is mostly in charge of the transplant process. Additionally, authorization, secrecy, and privacy are ensured by utilizing a private permissioned Ethereum blockchain.

5. EXPERIMENTAL SETUP

Hardware:Processor : i5 or above ,RAM : 4 GB ,HardDisk : 500Gb
Software: Language : Python 3.10 , Operating System : Windows 10/11 , IDE - Visual Studio Code ,Frontend Techologies : HTML,CSS,JS ,DataBase: SQL

6. APPLICATIONS AND FUTURE SCOPE

An organ donation tracking application in hospitals with blockchain technology holds the promise of transformative improvements. With blockchain's immutable record, transparency of organ donationoperations is ensured, and trust among the parties is enhanced. Advanced security features protect sensitive donor and recipient information against breaches and unwanted access. Real-time traceability makes organ allocation and utilization efficient, automating administrative procedures. Its cross-border compatibility makes international organ donation possible, bridging regulations and encouraging international cooperation. In addition, compatibility with IoT and AI enhances efficiency, tracking organ health in real-time and matching for transplant optimally. Lastly, blockchain provides regulatory compliance, making reporting and auditing easier, thus fast-tracking the use of ethical and responsible organ donation practices

7. CONCLUSIONS

In this work, we have designed a private Ethereum blockchain-based solution that handles organ donation and transplantation in a decentralized, accountable, auditable, traceable, secure, and trustworthy environment. We implemented smart contracts that maintain the data provenance by logging events automatically. We introduce six algorithms along with their implementation, testing, and validation information. We examine the security of the suggested solution to ensure that smart contracts are safeguarded from common attacks and weaknesses. We contrast our solution with other solutions that exist currently on the blockchain. We explain how our solution can

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easily be tailored to suit the needs of other systems facing the same issues. In the future, our solution can be enhanced by creating an end-to end DApp.Additionally, the smart contracts can be deployed and tested on an actual private Ethereum network. Lastly, the Quorum platform can ensure enhanced confidentiality since transactions between parties can be accessed only by particular participants and no one else, whereas in our solution, transactions between two participants are seen by other actors authorized within the private blockchain.

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