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Survey Paper on :"Organ Donation Using Blockchain"

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Abstract: *Organ donation is a critical issue that requires a secure and efficient system to ensure the timely and effective transfer of organs from donors to recipients. The traditional organ donation system is centralized, which leads to several challenges such as lack of transparency, fraud, and mismanagement. To address these challenges, blockchain technology can be used to create a decentralized and secure organ donation system. In this paper, we propose a blockchain-based organ donation system that enables real-time tracking of organs from donors to recipients, ensures the privacy and confidentiality of donor and recipient information, and provides a transparent and auditable system for all stakeholders involved in the process. Our system also includes smart contracts that automate the organ matching process, reduce waiting times for recipients, and minimize the risk of errors or miscommunications. Overall, our proposed blockchain-based organ donation system offers a promising solution to the challenges faced by traditional organ donation systems and has the potential to significantly improve the efficiency and effectiveness of organ donation processes.*

Keywords: Organ Donation, SHA, Blockchain, Etherium

I. INTRODUCTION

Organ donation is a selfless act that saves countless lives every year. However, the process of organ donation and transplantation is complex and fraught with challenges, such as the shortage of available organs, the need for accurate and secure medical records, and the potential for fraud and corruption in the system. Blockchain technology, with its decentralized, secure, and transparent nature, has the potential to revolutionize the organ donation and transplantation process. In this article, we will explore the benefits and challenges of using blockchain for organ donation, as well as some potential use cases and implementations. Blockchain provides a transparent and auditable ledger of all organ donation and transplantation activities, from the initial donation to the final transplantation. This ensures that all parties involved have access to the same information, reducing the risk of errors, fraud, and corruption. A blockchain-based donor registry could enable donors to securely and transparently register their organ donation preferences, improving the accuracy and completeness of the donor pool. A blockchain-based matching system could enable faster and more efficient matching of donors and recipients, reducing the time spent waiting for a suitable organ and improving overall transplantation outcomes. A blockchain-based medical records system could enable secure and transparent sharing of medical records between healthcare providers, improving the accuracy and completeness of medical information and reducing the risk of errors and miscommunications. A blockchain-based supply chain management system could enable secure and transparent tracking of organs from the initial donation to the final transplantation, improving the traceability and accountability of the organ donation process. Blockchain technology has the potential to revolutionize the organ donation and transplantation process, improving transparency, security, efficiency, and cost-effectiveness. However, the use of blockchain for organ donation raises complex regulatory, legal, technical, and cultural issues that must be addressed to ensure that blockchain-based organ donation systems are legally and ethically sound. As the technology continues to evolve, it will be important to explore potential use cases and implementations, such as donor registries, matching systems, medical records, and supply chain management, to realize the full potential of blockchain for organ donation.

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II. OBJECTIVE & SCOPE OF PROPOSED SYSTEM

The objective of implementing blockchain technology in organ donation is to create a secure, transparent, and efficient system for organ donation and transplantation. This system aims to address the challenges and limitations of the current organ donation process, such as the shortage of available organs, the need for accurate and secure medical records, and the potential for fraud and corruption in the system.

1. Improved Transparency: Blockchain provides a transparent and auditable ledger of all organ donation and transplantation activities, from the initial donation to the final transplantation. This ensures that all parties involved have access to the same information, reducing the risk of errors, fraud, and corruption.
2. Enhanced Security: Blockchain uses advanced cryptographic techniques to securely store and transmit sensitive medical data, reducing the risk of data breaches and unauthorized access.
3. Increased Efficiency: Blockchain enables faster and more efficient matching of donors and recipients, reducing the time spent waiting for a suitable organ and improving overall transplantation outcomes.
4. Reduced Costs: Blockchain eliminates the need for intermediaries and middlemen in the organ donation and transplantation process, reducing costs and improving overall efficiency.
5. Donor Registry: A blockchain-based donor registry can provide a secure and transparent system for organ donors to register their preferences, including the type of organs they wish to donate, their medical history, and their consent for organ donation. This system can also enable donors to easily revoke their consent or update their preferences, providing greater control and flexibility over their donation decisions.
6. Matching System: A blockchain-based matching system can enable faster and more efficient matching of donors and recipients, reducing the time spent waiting for a suitable organ and improving overall transplantation outcomes. This system can also provide greater transparency and traceability in the matching process, reducing the risk of errors and miscommunications.
7. Medical Records: A blockchain-based medical records system can enable secure and transparent sharing of medical records between healthcare providers, improving the accuracy and completeness of medical information and reducing the risk of errors and miscommunications. This system can also provide greater accessibility and portability of medical records, enabling patients to easily share their records with different healthcare providers.
8. Supply Chain Management: A blockchain-based supply chain management system can enable secure and transparent tracking of organs from the initial donation to the final transplantation, improving the traceability and accountability of the organ donation process. This system can also provide greater transparency and visibility into the entire supply chain, reducing the risk of fraud, corruption, and mismanagement.
9. Data Privacy and Security: A blockchain-based system can provide greater data privacy and security, reducing the risk of data breaches, unauthorized access, and misuse of sensitive medical data. This system can also enable greater control and ownership of medical data by patients, providing greater privacy and security in the sharing and use of medical data.
10. Regulatory and Legal Issues: A blockchain-based system can address the complex regulatory and legal issues surrounding organ donation, such as data privacy, consent, and liability. This system can also provide greater transparency and accountability in the organ donation process, reducing the risk of fraud, corruption, and mismanagement.

III. FEATURES OF PROJECT

1. Decentralization and Secure
2. Immutability
3. Smart Contracts
4. Data Privacy and Security
5. Transparency
6. Efficiency
7. Regulatory and Legal Issues
8. Reduced Costs

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IV. Literature Review

Diana Hawashin propose a private Ethereum block chain-based solution to enable organ donation and transplantation management in a manner that is fully decentralized, secure, traceable, auditable, private, and trustworthy. Develop smart contracts and present six algorithms along with their implementation, testing, and validation 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 solutions. We make the smart contract code publicly available on Github[1]

In this Paper, The black marketing of the organs is another major aspect which has led to an unorganized distribution of the organs. The existing system relies upon the central database system which includes the problems of reliability, immutability of the records and security of the data. The central database system lacks the validation methods for checking if the data has been modified or changed since they are the single source of information. This paper aims to solve the problem by using blockchain technology to store the records of the organs which can be tracked if any changes are occurred and stop the potential black marketing of the organs by verifying all the records that have been entered. The performance of the system will be measured based on the average response time of the system and the gas money used by the Ethereum Smart Contracts. We have found very low response times and lower cost of maintenance for the smart contacts, which shows that this approach can be used in the realtime organ transplant network.[2]

Repeated execution of a set of statements on satisfaction of a condition is not supported in traditional blockchain based smart contract developments. This is however important when multiple statements have to be inferred to derive towards a decision orientation system. Also, if the nature of the data is dynamic rather than fixed state one and if there is an availability of firmware to analyze the data, then the traditional approaches to perform experiments fail [4]. Hence, there is a need to set up the code in a manner that complies well with the aforementioned issues to provoke a smoother execution across the nodes. In addition to this, a compatiblsoftware testing framework is to be worked on to derive better outcomes. The implementation if in place will serve to be beneficial for multiple smart home based secure data across via blockchain network. [3]

Blockchain can be used in integration with various other domains such as machine learning, IoT, data analytics etc to solve the issues relevant to security, confidentiality and authentication. Different implementations of blockchain deal with different real-timescenarios based on the nature of emerging data. For example, ethereum is found to be efficient to prove security and decentralization properties, but scalability is still a challenging aspect to be proved. If there are users who want to attain better returns in the lonrun, then a compromise on decentralization is not possible [4].

As the time has passed and new trends have been settled in the technology stack, blockchain has also got more and more attention. Now, it is being used in almost every organization of the government and supply chain and in many other numerous areas. Blockchain has smoothed the problematic, time-consuming processes that were at the risk of failure. In simple words, it has made human more powerful towards the implementation of transparency and accountability and in maintaining trust and security. In this decentralized system, there is no intermediary intervention and the system can be evaluated for the required performance [5].

Blockchain Technology has been suggested and used by Kim et al. to regulate the blood cold chain. Using Hyperledger Composer, they put the prototype into practice. They have demonstrated the traceability of blood between various parties with their concept. Additionally, they have reasoned for rejecting blood if the blood temperature in storage is outside the typical range. [6]

For their investigation, Lakshminarayanan et al. studied 10 hospitals and two blood banks within a five-kilometre radius when they planned and constructed a blood donation system utilising Hyperledger Composer. The best blood is matched for a request based on blood group, location, and blood expiration date. When blood is used, the donor is informed, and if the blood is inappropriate for donation, the donor is also informed, and the blood is discarded. [7]

Mehmet and colleagues suggested the KanCoin Ethereum blockchain-based architecture in a chapter to manage and modify processes for effective distribution planning in the blood supply system from donors to distribution centers and patients at medical centers more efficiently than conventional procedures. [8]

Le, Hai Trieu, and colleagues proposed BloodChain in 2022 as an upgraded blood information management system that will provide more precise information about blood, such as blood use and disposal. For B2B (Business to Business) transactions, a private blockchain called BloodChain is being created. Performance evaluation of the system is carried out for several scenarios once it is constructed using Hyperledger Fabric. [9]

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Mr Qiuyun Lyu et.al has proposed a safe blockchain-based authentication methodology, known as SBAC, to ensure that rights holders can share review and revoke their information in such a secure manner. Ultimately, to accomplish decentralized security, and develop a corresponding framework and introduce a blockchain-based availability credential system to avoid system failure and preserve security with the review. The cuckoo filter is implemented for effective confirmation of control tokens demand. Also, our SBAC retains the attribute of omnipresent ICN optimization. [10]

Mary Subaja Christo et.al introduced Blockchain Technology as a deposited solution to providing protection when obtaining a people's clinical record. This proposed framework may also ensure patient protection and, besides, maintain the health care system's security and trustworthiness. The key core is to validate and acquire successful knowledge resources for today's social security systems using creativity in the squares network. [11]

Diogo F. Pacheco et.al It appears that organ-related social media interactions often appear to be correlated with elements of organ donation including such organ transplants similarities. We have found differences in the different organs that are debated prominently for every geographic area and that these differences tend to be correlated with facets of organ donation in that area. And these differences tend to be linked to facets of organ donation within this province, for example, the particular quantity of kidney interactions in Kansas. The unusual amount of kidney interactions in Kansas, the results indicate that the suggested method is capable of characterizing organ donation understanding in real-time. [12]

V. REPRESENTATION OF THE METHODOLOGY

In this paper the system proposed is a blockchain based organ donation system that would secure and automate the organ donation process while protecting sensitive patient and donor medical records using blockchain technology to eliminating any possibility of manipulation. It is designed specifically for use in the medical field related to organ donations, hospitals, System Centralized Distributed Decentralized donation process, and making it accessible while maintaining the integrity of the system.

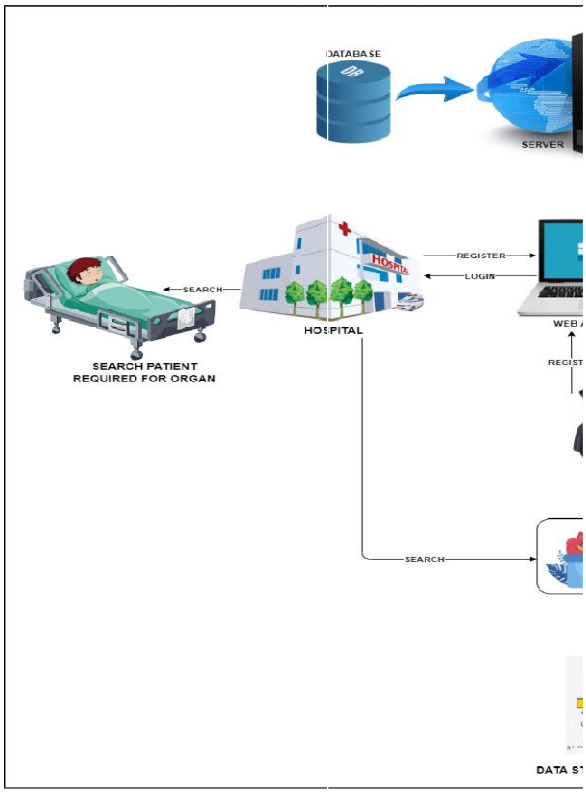

Fig : Representation Of The Methodology

It will provide an easy solution to maintain the anonymity of medical records.In this paper the system proposed is a blockchain based website that would secure and the organ donation process while protecting sensitive patient and donor

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medical records using blockchain technology to eliminating any possibility of manipulation. It is designed specifically for use in the medical field related to organ donations, hospitals, patients, organizing the donation process, and making it accessible while maintaining the integrity of the system. It will provide an easy solution to maintain the anonymity of medical records.

VI. PROGRAMMING ARCHITECTURE

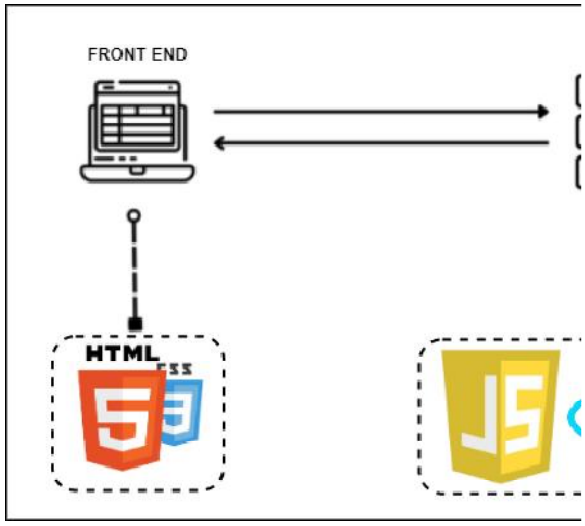

Figure: Programming Architecture

VII. ADVANTAGES

1. Improved Transparency and Traceability: Blockchain provides a transparent and auditable record of all organ donation and transplantation activities, from the initial donation to the final transplantation. This ensures that all parties involved have access to the same information, reducing the risk of errors, fraud, and corruption.
2. Faster and More Efficient Matching: Blockchain enables faster and more efficient matching of donors and recipients, reducing the time spent waiting for a suitable organ and improving overall transplantation outcomes.
3. Greater Data Privacy and Security: Blockchain provides greater data privacy and security, enabling greater control and ownership of medical data by patients, reducing the risk of data breaches, unauthorized access, and misuse of sensitive medical data.
4. Reduced Costs: Blockchain eliminates the need for intermediaries and middlemen in the organ donation and transplantation process, reducing costs and improving overall efficiency.
5. Improved Regulatory and Legal Compliance: Blockchain can address the complex regulatory and legal issues surrounding organ donation, such as data privacy, consent, and liability. This system can also provide greater transparency and accountability in the organ donation process, reducing the risk of fraud, corruption, and mismanagement.
6. Enhanced Patient Outcomes: Blockchain enables more accurate and complete medical records, improving the accuracy and completeness of medical information and reducing the risk of errors and miscommunications. This system can also provide greater accessibility and portability of medical records, enabling patients to easily share their records with different healthcare providers.
7. Increased Trust and Confidence: Blockchain provides a secure and transparent system for organ donation, increasing trust and confidence in the organ donation process among donors, recipients, and healthcare providers.

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VIII. APPLICATION AREAS

1. Donor Registration and Matching: Blockchain can be used to create a secure and transparent system for donor registration and matching, enabling faster and more efficient matching of donors and recipients.
2. Donor Consent and Data Privacy: Blockchain can be used to ensure that donor consent is obtained and recorded securely and transparently, reducing the risk of errors, fraud, and misuse of sensitive medical data.
3. Transplantation and Follow-up Care: Blockchain can be used to create a secure and transparent system for organ transplantation and follow-up care, enabling greater accuracy and completeness of medical information and reducing the risk of errors and miscommunications.
4. Supply Chain Management: Blockchain can be used to create a secure and transparent system for organ transportation, storage, and distribution, reducing the risk of errors, fraud, and mismanagement.
5. Research and Development: Blockchain can be used to create a secure and transparent system for organ donation research and development, enabling greater collaboration and sharing of medical data and reducing the risk of errors and miscommunications.
6. Regulatory and Legal Compliance: Blockchain can be used to create a secure and transparent system for regulatory and legal compliance in organ donation, reducing the risk of fraud, corruption, and mismanagement.
7. Patient Outcomes and Quality of Care: Blockchain can be used to create a secure and transparent system for patient outcomes and quality of care in organ donation, enabling greater accuracy and completeness of medical information and reducing the risk of errors and miscommunications.

IX. HARDWARE REQUIREMENTS

1. CPU Quad Core (not counting hyper-threading) 2.4Ghz, Intel VT or AMDV (Intel i3 or better)
2. Memory 4 GB
3. The ability to install more memory is desirable. Disk 512 GB SSD or better
4. Graphics Accelerated, Gaming Support Nvidia is preferred over AMD 1920 by 1080 resolution is recommended (at least on an external port) At least 1280 by 1024 resolution
5. HDMI output recommended (perhaps with an adapter)
6. Mouse An external mouse (USB or Bluetooth) is desirable.
7. USB USB 3.0 desirable for an external disk Other USB ports may be needed for: mouse, printer, mic-in, and headphones-out, depending on how these are connected.
8. External monitor A 23” or larger HDMI monitor is recommended, with reasonable resolution.
9. Laptop or Desktop Windows 11 or macOS 12.4 or above. Linux is also acceptable if a mainstream distribution (e.g. Ubuntu).

X. SOFTWARE REQUIREMENTS

1. Operating System: Windows, 10, 7, 8. and later versions
2. Front End: HTML,CSS
3. Programming Language: Solidity, ReactJS, Javascript
4. Database: Firebase.
5. Tool: Etherium
6. Technology: Blockchain
7. Algorithm: SHA

XI. TEST DATA REQUIREMENTS

Unit Testing

Unit testing concentrates verification on the smallest element of the program – the module. Using the detailed design description important control paths are tested to establish errors within the bounds of the module.In this system each sub module is tested individually as per the unit testing such as campaign, lead, contact etc are tested individually. Their input field validations are test

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Integration testing

Once all the individual units have been tested there is a need to test how they were put together to ensure no data is lost across interface, one module does not have an adverse impact onanother and a function is not performed correctly. After unit testing each and every sub module is tested with integrating each other.

XII. SYSTEM TESTING FOR THE CURRENT SYSTEM

In this level of testing we are testing the system as a whole after integrating all the main modules of the project. We are testing whether system is giving correct output or not. All the modules were integrated and the flow of information among different modules was checked. It was also checked that whether the flow of data is as per the requirements or not. It was also checked that whether any particular module is non-functioning or not i.e. once the integration is over each and every module is functioning in its entirety or not.

1. Functional testing: this involves testing the functionality of the system to ensure that it meets the required specifications and performs as expected. This includes testing the churn prediction accuracy, input data handling, and output interpretation.
2. Performance testing: this involves testing the system's performance under different load conditions to ensure that it can handle the expected workload and respond within acceptable time limits. This includes testing the system's scalability, resource utilization, and response time.
3. Security testing: this involves testing the system's security features to ensure that it can protect sensitive customer data from unauthorized access, theft, or misuse. This includes testing the system's authentication, authorization, and encryption mechanisms.
4. Compatibility testing: this involves testing the system's compatibility with different operating systems, databases, and hardware configurations to ensure that it can operate in a variety of environments.
5. Usability testing: this involves testing the system's user interface and user experience to ensure that it is intuitive, easy to use, and meets the needs of the end-users.
6. Regression testing: this involves testing the system's functionality after making changes or updates to ensure that the changes have not introduced any unintended side effects or regressions.
7. Acceptance testing: this involves testing the system's functionality from the perspective of the end-users to ensure that it meets their requirements and expectations. This includes testing the system's accuracy, reliability, and ease of use.
8. Recovery testing: this involves testing the system's ability to recover from failures, errors, or disasters to ensure that it can continue operating and providing service to the end-users.
9. Stress testing: this involves testing the system's performance under extreme load conditions to ensure that it can handle unexpected or catastrophic events.
10. Exploratory testing: this involves testing the system's functionality and behavior in unanticipated or unexpected scenarios to ensure that it can handle unexpected situations and provide accurate and reliable results.In this level of testing we tested the following: -

- Whether all the forms are properly working or not.
- Whether all the forms are properly linked or not.
- Whether all the images are properly displayed or not.
- Whether data retrieval is proper or not

XIII. CONCLUSION

In conclusion, the traditional organ donation system has several limitations that hinder its effectiveness and efficiency. Blockchain technology offers a promising solution to these challenges by providing a decentralized, secure, and transparent system for organ donation. Our proposed blockchain-based organ donation system offers several benefits such as real-time tracking of organs, privacy and confidentiality of donor and recipient information, smart contracts for automating the organ matching process, and reducing waiting times for recipients. By implementing a blockchain-based organ donation system, we can significantly improve the efficiency and effectiveness of organ donation processes, reduce fraud and mismanagement, and ultimately save more lives. However, there are still some challenges that need to

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be addressed such as scalability, interoperability, and regulatory issues. Further research and development are required to overcome these challenges and fully realize the potential of blockchain technology in organ donation.

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