ORGAN MATCHING AND TRANSPLANTATION

[1]B. Vijayalakshmi [2]A. Sruthika [3]P. Reena Sultana [4]K. Jahnavi
[5]A. Geethika [6]V. Mounika

[1]Assistant Professor, CSE Department, Narayana Engineering College, Nellore, Andhra Pradesh, India

[2,3,4,5&6]UG Scholars, Department of CSE, Narayana Engineering College, Nellore, Andhra Pradesh, India

Abstract: *In this project Organ Matching and transplantation, we are using Blockchain Technology to handle hospital, donor and patient's (user details). Hospitals will be responsible to log all donors and user details and then search for match between donor and user and once matched found then alert will be sent to both users and donors. Both donor and user can monitor matched status using their ID provided by hospital peoples. Various hospitals can register and then login to application to maintain all donor and user information. Earlier there were centralized servers which were used to save all the user information and this server will be handled by admins who can have complete access to database and they can tamper or see details very easily and there is no direct method for the users to know about data leakage or tamper. Centralized servers can be easily attacked by hackers and can crash or steal information from servers and in such a case, server will be unavailable and services will be disrupted for users. To avoid all above problems all applications are shifting to decentralized Blockchain services because Blockchain has inbuilt data encryption support and store every data as block or transaction and assign each block with unique hash code and while storing new Blocks it will check hash code of all previous blocks and if data is not tamper then it will lead to same hash code and verification will become successful and if change then verification get failed and because of this reason Blockchain will be regarded as immutable. Blockchain is known as decentralized, i.e., Blockchain store data at multiple servers or node and if one server is down then it can access services from other working nodes. Blockchain deal with all data through smart contract and this contract will be developed through Solidity programming. Smart contract have function to save and retrieve data from Blockchain. In propose work to manage hospital details we have designed following smart contract's function.*

Index Terms - *Hospitals, Donors, Patients, View transplantation, Blockchain.*

I.INTRODUCTION

Organ transplantation is a critical and life-saving medical procedure that depends on precise organ matching to ensure compatibility and successful patient recovery. The matching process involves several crucial factors, including blood type compatibility, tissue matching, and the medical urgency of the recipient. As promising as medical science has become, organ transplantation itself is fraught with challenges, ranging from organ deficiencies, lengthy waiting lists, to issues of lack of transparency within the allocation mechanism. To bridge these gaps, the incorporation of cutting-edge technology such as Blockchain can be that game-changing contribution to improving organ allocation systems for greater security, equity, and efficiency. Blockchain technology guarantees tamper-evident record-keeping, traceability, and transparency, reducing the chances of unethical activities and unauthorized changes in donor-recipient matching. Utilizing such technologies, this method is meant to maximize organ distribution, enhance patient outcomes, and create a more efficient and fair transplant system that saves more lives.

II. EXISTING WORK

The current healthcare data management system is essentially defined by its dependency on a centralized infrastructure. This infrastructure generally includes a cluster of servers, databases, and applications that reside in a physical data center, either located on-premises at a hospital or provided by a third-party vendor. The system is architected to support a range of healthcare data types, such as patient demographics, medical histories, treatment records, diagnostic imaging, and billing. Data entry is usually done via electronic health record (EHR) systems or other clinical software, where healthcare workers enter the information of patients. These data are saved in relational databases, where data are stored as tables with well-defined relationships. User authentication and authorization mechanisms keep access to these databases under control, usually using usernames, passwords, and role-based access control.

The system's operational model emphasizes administrative control, with IT staff and administrators having broad privileges to manage data, configure system settings, and perform maintenance tasks. This centralized control, while efficient for routine operations, creates a significant point of vulnerability.

Disadvantages:

Security Weakness: The centralization of the system puts sensitive information at a high risk of violation since a successful attack will compromise a large amount of patient data.

Data Tampering: System administrators with wide-ranging access rights can potentially modify or manipulate information, violating the integrity and authenticity of healthcare records.

Downtime: Server crashes or maintenance can cause service outages, preventing healthcare providers and patients from accessing important information, which can affect patient care.

Lack of Transparency: Patients and donors lack insight into how their data is being utilized or safeguarded, causing them to lose trust in the system.

Data Theft: The aggregation of valuable medical and personal data makes the system an attractive target for data thieves, with successful breaches leading to the theft of patient information.

Single Point of Failure: The use of a single main server exposes the entire system to potential catastrophic failures.

Lack of Auditability: Without complete logs, it is hard to trace who accessed and altered data, making it hard to comply with regulations.

III. PROPOSED WORK

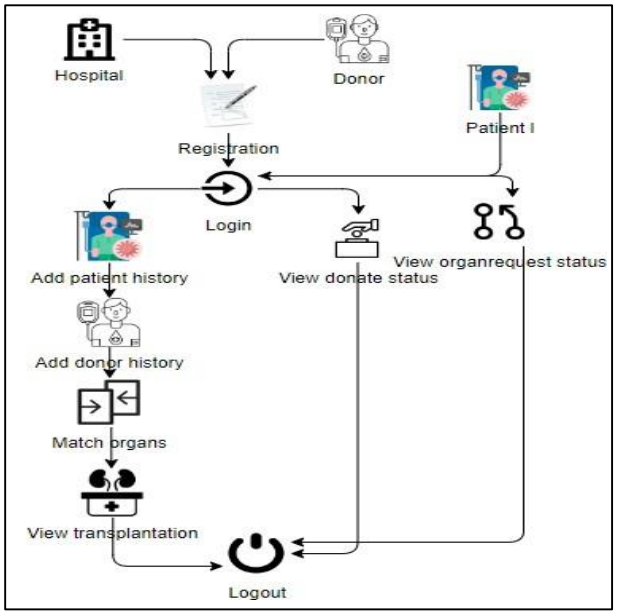
The suggested system will radically revolutionize healthcare data management through the inherent power of blockchain technology. It deviates from the conventional centralized paradigm, instead of setting up a decentralized system with data distributed over many nodes. This decentralization is the bedrock of the system's greater security and stability.

Benefits:

Enhanced Data Integrity: The immutability and tamper-evident nature of blockchain ensure the reliability of healthcare records, ensuring no unauthorized modifications and data accuracy.

Enhanced System Resilience: The decentralized design provides constant availability, keeping downtime and service interruptions to a bare minimum, as the system does not rely on a single point of failure. Improved User Transparency: Donors and patients gain greater transparency and control over their data, which allows them to monitor their medical records and match status, promoting accountability and trust. Stronger Data Protection: Blockchain protects against data breaches and theft, preserving patient privacy and sensitive medical data, minimizing the threat of identity theft and fraud. Single Point of Failure Elimination: The distributed network structure eliminates the risk of a single point of failure, improving system reliability and availability.

Design:



These blocks visualize an organ matching and transplant system workflow, mapping the communications between hospitals, patients, and donors. The process begins with the registration of patients, donors, and hospitals. Once logged in, the authorized users can take different actions. Hospitals can add donor and patient histories, match organs according to compatibility, and monitor the transplantation process. Donors can monitor the status of their organ donation, whereas patients can monitor the status of their organ request. The system gives the facility for users to log out as soon as they complete their work, hence a well-organized and safe process of organ transplantation management.

IV. EXPERIMENTAL RESULTS

Hospital Module:

- Hospitals register by providing hospital name, address, contact details, and credentials.
- Patients register by providing name, address, contact details, and credentials.
- Hospitals log in using unique credentials, while patients log in using their User ID.
- Hospitals add patient details, including Patient ID, name, age, contact information, medical history, and required organ type.

- Hospitals add donor details, including Donor ID, name, age, contact information, organ type, and medical compatibility.
- Donors and patients receive a verification email with their unique Donor ID or Patient ID.
- When a match is found, hospitals send an alert message to the patient notifying them of a suitable donor match and the next steps.
- Hospitals can view completed or upcoming transplantations, including donor and patient details, organ type, and status.
- Hospitals can securely log out to prevent unauthorized access.

Donor Module:

- Donors can log in using their Donor ID provided in the verification email.
- Donors can track the status of their donations, including whether their organ has been matched with a patient and the current stage of the transplantation process.
- This information is retrieved from the Blockchain in real-time.
- Donors can check if a match has been found by viewing the status.
- Donors can securely log out of the system to protect their data.

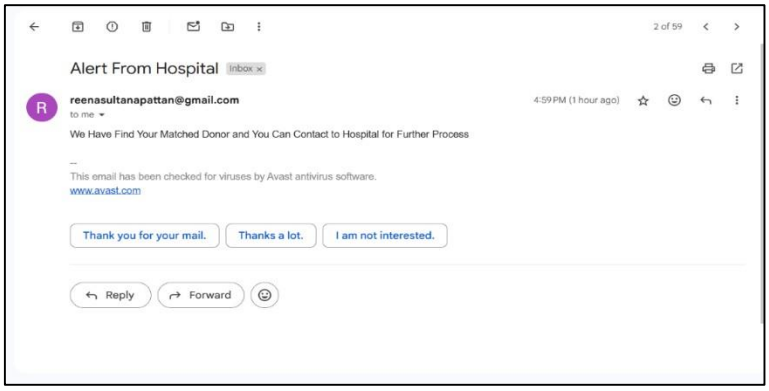
Patient Module:

- Patients can log in using their unique credentials (Patient ID) provided in the verification email.
- Patients can check the status on the website to see if their organ match has been found, with details related to their organ type, but not the donor information.
- If a match is found, they receive an alert message with the matched details and instructions for further steps.
- Patients can securely log out of the system to protect their data.

All the three users can login into this home page using their login credentials.

The Hospital dashboard adds patients and donor details into the system. The above screen shows the hospital dashboard adding patients and is similar in adding donors.

The above screens indicates that the match is identified for the patient. When a hospital matches a donor for a patient the donate status in donor dashboard is as per above figure(right).



The page above demonstrates the confirmation email sent to patient and donor by the hospital once there is a a match.

V. CONCLUSION

Lastly, our project marks a big leap toward revolutionizing healthcare data management with the judicious use of blockchain technology. In taking the necessary leap towards mitigating the vulnerabilities endemic to traditional centralized models, we have illustrated the practicality and deeply beneficial implications of a decentralized approach. The successful deployment of our blockchain platform highlights its potential to transform how sensitive patient and donor data are managed to provide a better level of security, transparency, and efficiency. The results of the project affirm the fundamental assumption that blockchain can successfully counter risks posed by data breaches, manipulation, and service interruptions, thus creating a safer and more resilient healthcare environment. The increased security provided by cryptographic encryption and the data immutability of the blockchain ledger highlights the system's capacity to protect sensitive information. Such is especially important in the healthcare industry, where confidentiality of patient information is at the top of concern. Additionally, the computerized organ matching process enabled by smart contracts has been able to demonstrate potential for minimizing core operations to reduce waiting times and enhance patient outcomes. The enhanced user transparency and control provided by the system have also illustrated the potential of blockchain to enable stakeholders and facilitate trust. Scalability and always-on availability, provided by the system through its decentralized architecture, solve a significant limitation of legacy systems. This illustrates the appropriateness of blockchain in developing resilient and flexible healthcare infrastructure. Nevertheless, the project also points to the need to address a number of key considerations for mass adoption. These are ensuring compliance with regulations, ensuring interoperability with current systems, encouraging user adoption through training and education, and overcoming scalability issues.

The successful deployment of this system marks a major milestone toward a future where healthcare information is securely, transparently, and efficiently managed, ultimately serving patients and healthcare providers better. The knowledge developed here will be the launching point for ongoing innovation and further development of even more advanced blockchain-based healthcare technology.

VI. REFERENCES

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