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Blockchain-Enabled Smart Organ Transplant Matching System

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Abstract: *Organ transplantation is a critical medical process that requires transparency, accuracy, and security to prevent illegal activities and ensure fair allocation of organs. This project proposes a Blockchain-Based Organ Transplant Management System that integrates secure data storage with an automated donor-recipient matching mechanism. The system enables donor and recipient registration, document verification, and real-time tracking of transplant processes. Blockchain technology is used to store approval records, matching details, and transplant logs, ensuring immutability and preventing data tampering. Additionally, an automatic matching algorithm based on blood group and organ compatibility improves efficiency and reduces manual intervention. This system enhances trust, transparency, and reliability in organ transplant management*

Keywords: Blockchain, Organ Transplant, Healthcare System, Smart Matching, Secure Records

I. INTRODUCTION

Organ transplantation is a life-saving procedure, but the current system faces challenges such as lack of transparency, illegal organ trade, and inefficient matching processes. Traditional systems rely heavily on manual verification and centralized databases, which are vulnerable to manipulation and delays.

To overcome these issues, this project introduces a Blockchain-Based Organ Transplant Management System. The system ensures secure and tamper-proof storage of medical and transplant records using blockchain technology. It also includes an automated matching mechanism that identifies compatible donors and recipients based on medical parameters such as blood group and organ type.

By combining blockchain with intelligent matching, the system improves fairness, reduces fraud, and enhances efficiency in organ transplantation.

II. LITERATURE SURVEY

Several research studies have explored healthcare digitization and secure data management. Various blockchain-based solutions have been proposed for secure medical record management, and automated matching algorithms have been studied for improving organ allocation efficiency.

[1] A. Dubovitskaya et al., Journal of Medical Internet Research, 2017 – "Secure and Trustable Electronic Medical Records Sharing using Blockchain". Explores the use of blockchain to enable secure sharing of electronic medical records, emphasizing data integrity and patient privacy.

[2] M. Ogundele et al., IEEE Blockchain Conference, 2019 – "Blockchain Technology for Healthcare Data Management". Discusses the application of distributed ledger technology to prevent unauthorized modification of clinical records.

[3] S. Angraal et al., JAMA Cardiology, 2017 – "Blockchain Technology: Applications in Health Care". Reviews the potential of blockchain to improve transparency and security across various healthcare workflows.

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[4] K. Rabah, Mara Research Journal of Medicine and Health Sciences, 2017 – "Challenges & Opportunities for Blockchain Powered Healthcare Systems". Identifies the critical gap between existing centralized systems and the need for tamper-proof organ transplant records.
[5] T. McGhin et al., Journal of Network and Computer Applications, 2019 – "Blockchain in Healthcare Applications". Examines smart contract-based automation in medical workflows and its suitability for matching algorithms.
[6] R. Guo et al., IEEE Access, 2018 – "Secure Attribute-Based Signature Scheme with Multiple Authorities for Blockchain in Electronic Health Records Systems". Focuses on multi-authority access control and verification, relevant to the admin approval module in this system.
[7] F. Casino et al., Telematics and Informatics, 2019 – "A Systematic Literature Review of Blockchain-Based Applications". Provides a broad overview of blockchain use cases in healthcare, including organ donation and transplant traceability.
[8] L. Ismail & H. Materwala, IEEE Access, 2019 – "A Review of Blockchain Architecture and Consensus Protocols". Covers permissioned blockchain architectures and their suitability for sensitive medical data applications like organ transplant management.
[9] X. Liang et al., IEEE 13th International Symposium, 2017 – "Integrating Blockchain for Data Sharing and Collaboration in Mobile Healthcare Applications". Demonstrates how blockchain can support real-time data sharing between donors, recipients, and hospitals, directly applicable to transplant coordination.
However, most existing systems lack integration between secure storage and intelligent matching. This project addresses that gap by combining blockchain with automated donor-recipient matching.

III. METHODOLOGY

3.1 Data Collection & User Registration

The system collects data from donors and recipients, including personal details, medical history, blood group, and required organ type. Users must upload necessary documents such as medical reports and consent forms.

3.2 Admin Verification

An admin verifies the uploaded documents and approves or rejects applications. Only verified donors and recipients are allowed to proceed in the system.

3.3 Automatic Matching System

Once a recipient is approved, the system automatically searches for compatible donors. The matching process is based on:

- Blood group compatibility
- Organ type
- Medical priority

The system selects the best match and generates a match record.

3.4 Blockchain Integration

All critical operations are stored on the blockchain, including:

- Donor approval
- Recipient approval
- Matching records
- Transplant completion

Each record is stored as a block, ensuring immutability and transparency.

3.5 Transplant Process Management

After matching, the surgery is scheduled and the transplant process is completed. The final status is updated and all updates are securely stored in the blockchain.

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IV. SYSTEM ARCHITECTURE

This project is designed to efficiently manage organ transplant records and provide secure donor-recipient matching using Blockchain technology.

4.1 User Interface (Frontend)

A web-based interface allows users to register as donor or recipient, upload documents, and view status updates in real time.

4.2 Backend Server

Handles authentication and role management, data processing, matching logic, and API communication between the frontend and blockchain layers.

4.3 Database (MongoDB)

Stores user details, medical records, and application status. MongoDB is used for flexible schema management suited to varied medical data structures.

4.4 Blockchain Layer

Stores approval logs, matching records, and transplant history. Ensures data security, tamper-proof records, and full transparency of all transplant-related events.

4.5 Matching Engine

Automatically identifies compatible donors and recipients based on blood group, organ type, and medical priority, reducing manual work and improving allocation efficiency.

4.6 FLOWCHART.

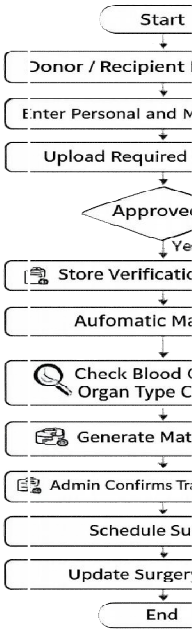

FIGURE 4.1 Blockchain-Based Organ Transplant System Flowchart.

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V. RESULTS AND DISCUSSION

5.1 OUTPUT

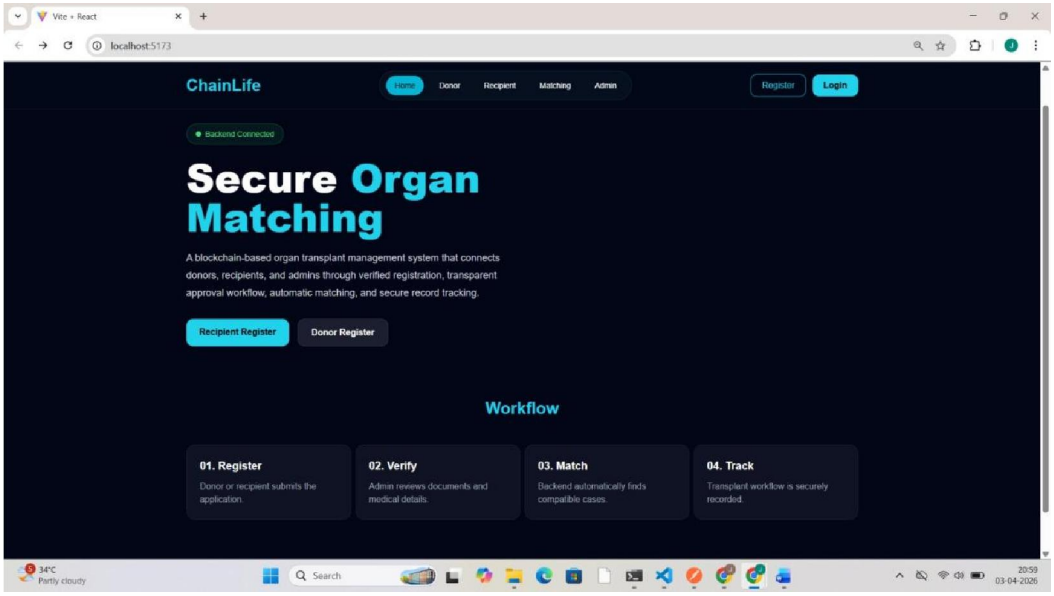

FIGURE 5.1

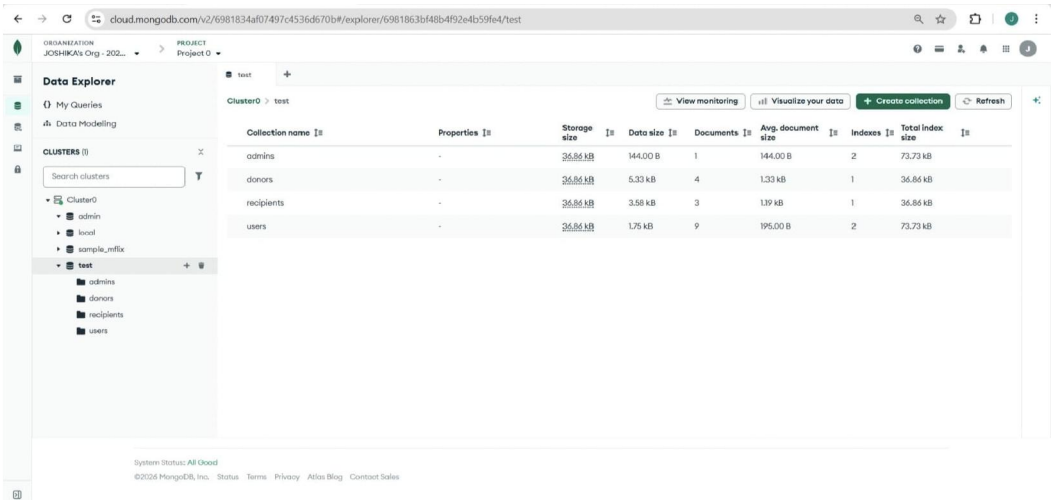

FIGURE 5.2

5.2 SYSTEM PERFORMANCE

The system successfully registers users, verifies documents, and automatically matches donors and recipients. All records are stored securely on the blockchain. The system demonstrates faster matching compared to manual processes, improved transparency, reduced chances of fraud, and secure data handling throughout.

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5.3 CHALLENGES AND SOLUTIONS

Challenge	Solution
Data security	Blockchain implementation
Manual errors	Automated matching
Fraud risk	Immutable records
System complexity	Modular architecture

VI. CONCLUSION

The proposed intelligent career guidance system helps students choose suitable career paths based on their skills, academic performance, and interests. Unlike traditional methods, it provides personalized and accurate recommendations using data-driven analysis. The system reduces confusion and supports better decision-making by identifying individual strengths and matching them with appropriate careers. It is user-friendly, efficient, and reliable for students seeking guidance. Additionally, the system can be further improved by integrating advanced technologies like machine learning and real-time data analysis. Overall, this project contributes to better career planning and helps students build a successful future aligned with their potential.

VII. ACKNOWLEDGMENT

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