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A Blockchain-Enabled Framework for Streamlining Organ Donation and Transplantation Processes

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Abstract: Organ donation and transplantation processes face numerous challenges, including donor registration, organ allocation, transportation logistics, and ethical compliance. To address these issues comprehensively, we present a blockchain-based framework utilizing private Ethereum smart contracts. This decentralized system enhances transparency, data security, and trust across all stakeholders involved. By implementing smart contracts and designing specific algorithms, we ensure accurate tracking and secure data handling throughout the process. We evaluate the framework through performance and security assessments, demonstrating its feasibility and advantages compared to conventional approaches.

Keywords: *Blockchain, Ethereum, Confidentiality, Contracts, Organ Donation, Transplantation,Trustworthy.*

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I. INTRODUCTION

Organ failure or damage can result from injury or illness, significantly impacting a person's quality of life and, in severe cases, leading to death. Donating an organ is considered one of the most noble acts of humanity, offering a chance to save lives through transplantation.

For a transplant to be successful, the donated organ must be in good working condition, there must be a compatible match between donor and recipient, and the donation must not pose a life-threatening risk to the donor.

The first successful organ transplant took place in 1954, involving a kidney transplant between identical twin sisters. Since then, the number of transplants performed annually has continued to grow. However, the demand for organs still greatly exceeds the number of available donors.

Tragically, around 20 people die each day while waiting for an organ transplant, and every 10 minutes, a new patient is added to the waiting list.

Being placed on the organ transplant waiting list is a crucial first step in the allocation process. However, access to this list can be influenced by geographic and socioeconomic factors. Therefore, it is vital that the allocation process remains fair and does not discriminate against any group of patients.

II. LITERATURE SURVEY

*N.Mattei, A.Saffidine, and T.Walsh are working on Mechanisms for online organ matching in the 2017 in Matching ways on a simple Mechanisms to perform this matching and compare this new medium with the more complex algorithm.

Shahrani, A.A.Al- Zuraib, and R.Merlin Mathew are working on Organ Donation and Decentralised operations using blockchain technology in the 2019 on Blockchain Technology in the system would work on a first-- out base unless a case is in critical condition.

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P.Ranjan, S.Srivastava, V.Gupta, S.Tapaswi, and N.Kumar are working on a Decentralised and distributed system for organ/ kerchief donation and Transplantation in 2019 onBlockchain, Healthcarer, Transparent, Securer Decentralised Organ Donation IPFS and this paper presents a Decentralised, secure and transparent Organ and kerchief transplant web operation.

M.He, A.Corson, J.Russo, and T.Trey are working on Organ procurement and Organ trafficking practices in regions that block transparent access to their transplant data in 2020 on Organ trafficking, Organ tourism, translucence, forced Organ harvesting, prisoner of heart in Archival autopsies from Transplant philanthropist's patron organs will give DNA lives of donors.

Department of Health and Human Services on Organ Procurement and Transplantation Network in 2021 on Blockchain Based Network, Supply Chain Management in icing equity in access to Transplantation requires assessment and mitigation of structural walls disproportionately impacting disadvantage implicit contenders who could medically benefit from Transplantation

III. EXISTING SYSTEM

The being systems for organ donation and transplantation incorporate colorful technologies to meliorate effectiveness, limpidity, and fairness. Amulti-agent software platform was developed to pretend the information workflow among hospitals and controllers, reducingpre- transplantation time by over to five hours.The MIN medium proposed in Australia enhances the fairness of organ matching by minimizing the difference between KDPI and EPTS scores. And also, several blockchain- rested systems have been introduced, allowing cases and benefactors to register via secure web operations using smart contracts and a FIFO approach, with precedence given to critical cases. These blockchain models offer enhanced limpidity and faster processing but bear indigenous acclimations to align with original regulations.

IV. PROPOSED SYSTEM

The proposed work introduces a private Ethereum blockchain- grounded system for managing organ donation and transplantation in a decentralized, secure, and transparent manner. It utilizes smart contracts to register all involved actors and ensures data integrity by generating events for each action during the donation and transplantation process, with the law made intimately available on GitHub. An automated matching medium is enforced within the smart contracts, grounded on predefined criteria to link benefactors and donors. The system also includes six algorithms, each completely enforced, tested, and validated. A comprehensive security analysis is conducted to demonstrate the system's adaptability against common pitfalls. The proposed result is compared with being approaches to punctuate its oneness and can be acclimated for other affiliated operations.

V. RELATED WORK

A. Requirement Analysis:

Understand and analyze the requirements of the organ donation and transplantation system, including the needs of donors, patients, and hospitals. Identify all user roles and define their functionality and access levels.

B. System Design:

- Design a user-friendly interface for donors, patients, and hospital administrators using JSP and servlets.
- Design the database schema for storing user profiles, organ details, transaction data, etc.
- Plan the blockchain implementation, defining how organ donations will be recorded and validated.
- Develop a flowchart and architecture for the entire system, detailing how each module interacts with others.

C. Database Development:

- Create MySQL tables to store relevant data like user profiles, organ types, donation records, and blockchain transaction information.
- Define relationships and queries for data retrieval and updates.

D. Implementation:

- Develop the system using Java 8, JSP, and servlets.
- Implement all modules—Hospital, Donor, and Patient—with specific functionalities like profile management, donation details, transplantation registration, etc.
- Implement blockchain functionality for recording organ donations as immutable transactions.
- Integrate the MySQL database for data storage and retrieval.

In this, there are substantially three modules.

- benefactors • In this module, the Donor will register and login also uploads their organ patron data to the Sanitarium and will do the following operations similar as View Profile, shoot Organ giving Details, View Organ Donated Details Status.
- Cases • In this module, cases logs in by using his/ her stoner name and word. After Login stoner will do some operations similar as My Profile, Register For Organ Transplantation, View All Organ Transplantation Details.
- Hospital • The Hospital manages Hospital records to give organ storehouse service for donation and transplantation and also performs the following operations similar as View all Cases and Authorize, View all benefactors and Authorize, Add Organ Type, View All Blockchain Hash law 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.

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VI. SAMPLE OUTPUTS

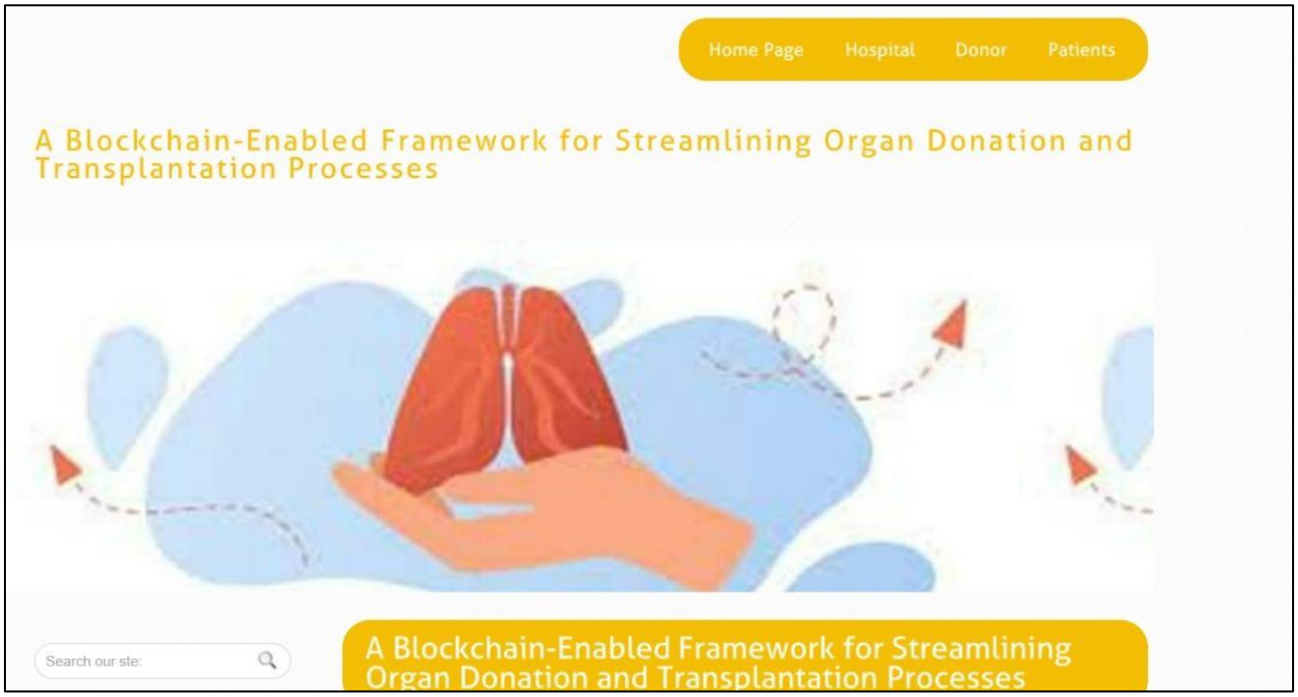

Fig-1: Overview of Project

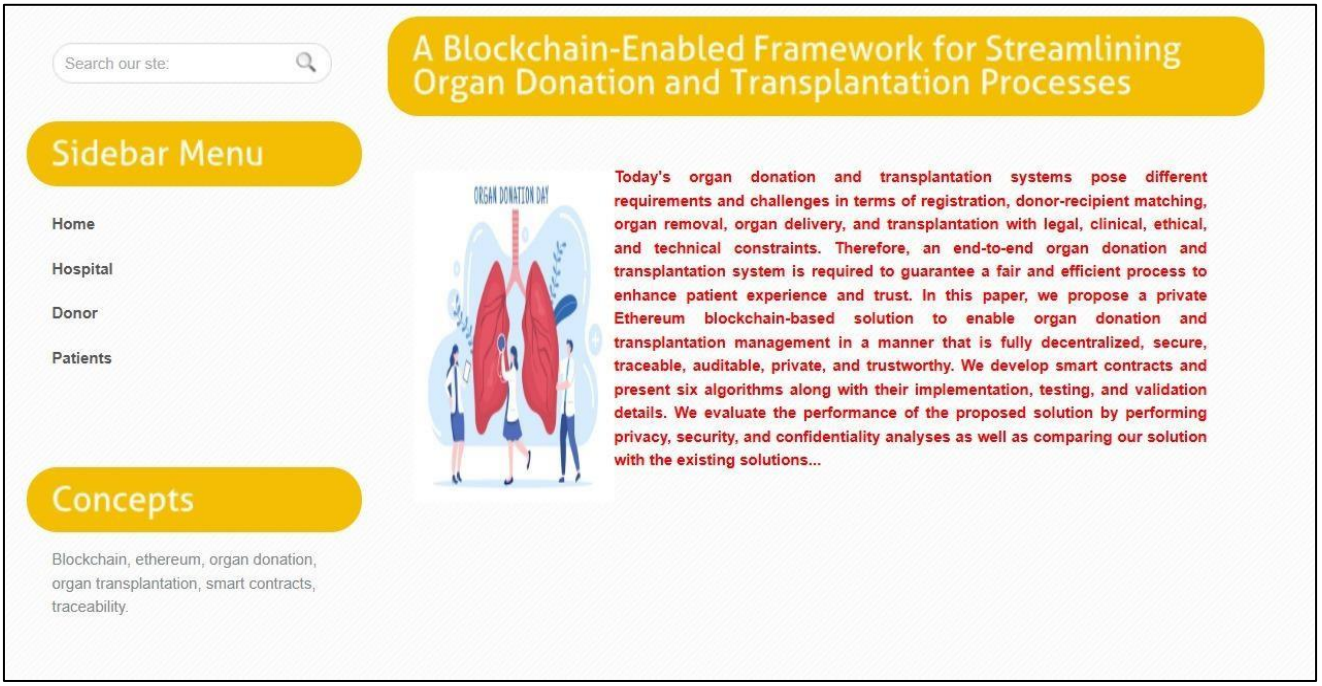

Fig-2: Modules of Project

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Fig-3: Hospital Login

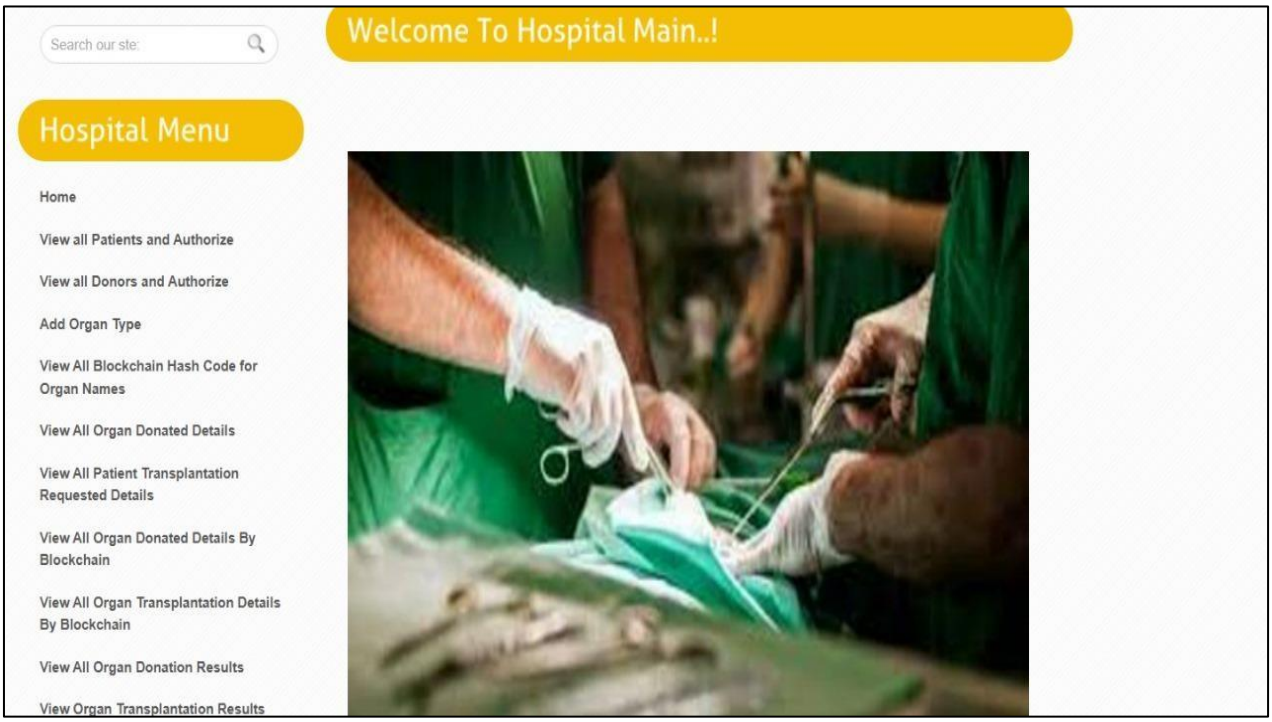

Fig-4: Hospital Menu

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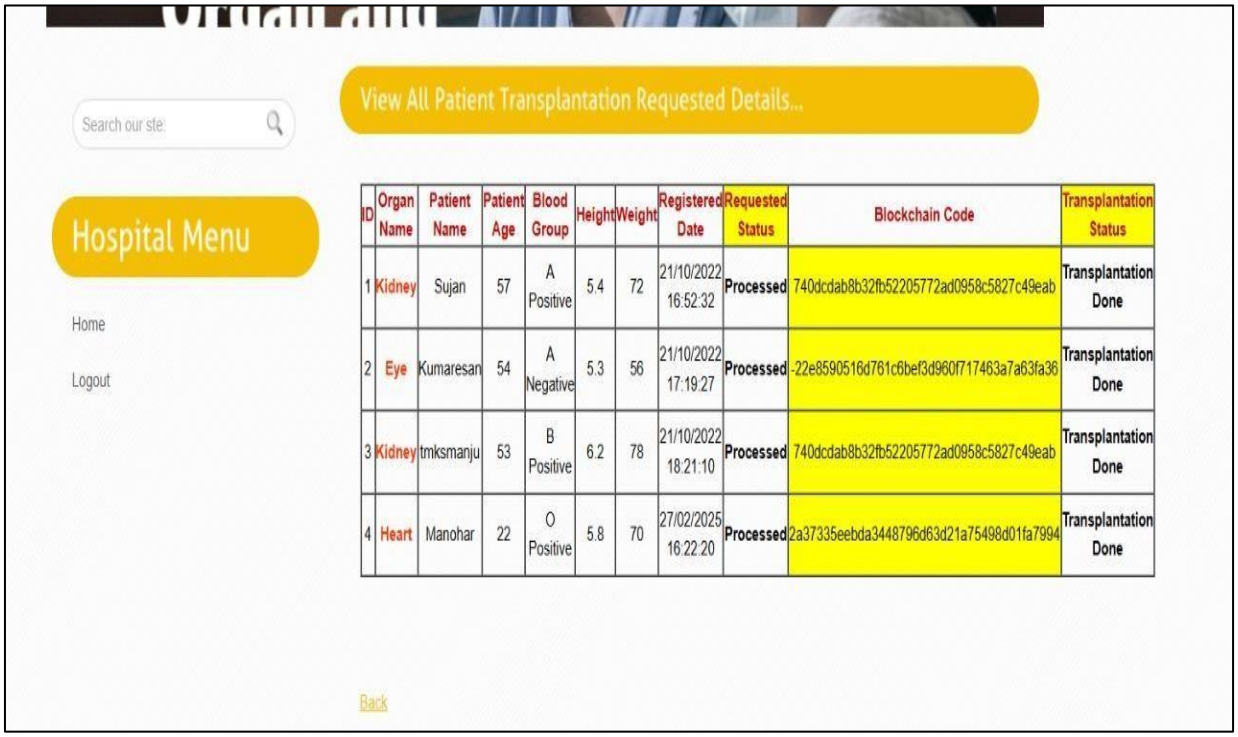
Fig-6: Donar Login



ID	Organ Name	Patient Name	Patient Age	Blood Group	Height	Weight	Registered Date	Requested Status	Blockchain Code	Transplantation Status
1	Kidney	Sujan	57	A Positive	5.4	72	21/10/2022 16:52:32	Processed	740dcdab8b32fb52205772ad0958c5827c49eab	Transplantation Done
2	Eye	Kumaresan	54	A Negative	5.3	56	21/10/2022 17:19:27	Processed	-22e8590516d761c6bef3d960f717463a7a63fa36	Transplantation Done
3	Kidney	tmksmanju	53	B Positive	6.2	78	21/10/2022 18:21:10	Processed	740dcdab8b32fb52205772ad0958c5827c49eab	Transplantation Done
4	Heart	Manohar	22	O Positive	5.8	70	27/02/2025 16:22:20	Processed	2a37335eebda3448796d63d21a75498d01fa7994	Transplantation Done

Fig-5: Hospital Details

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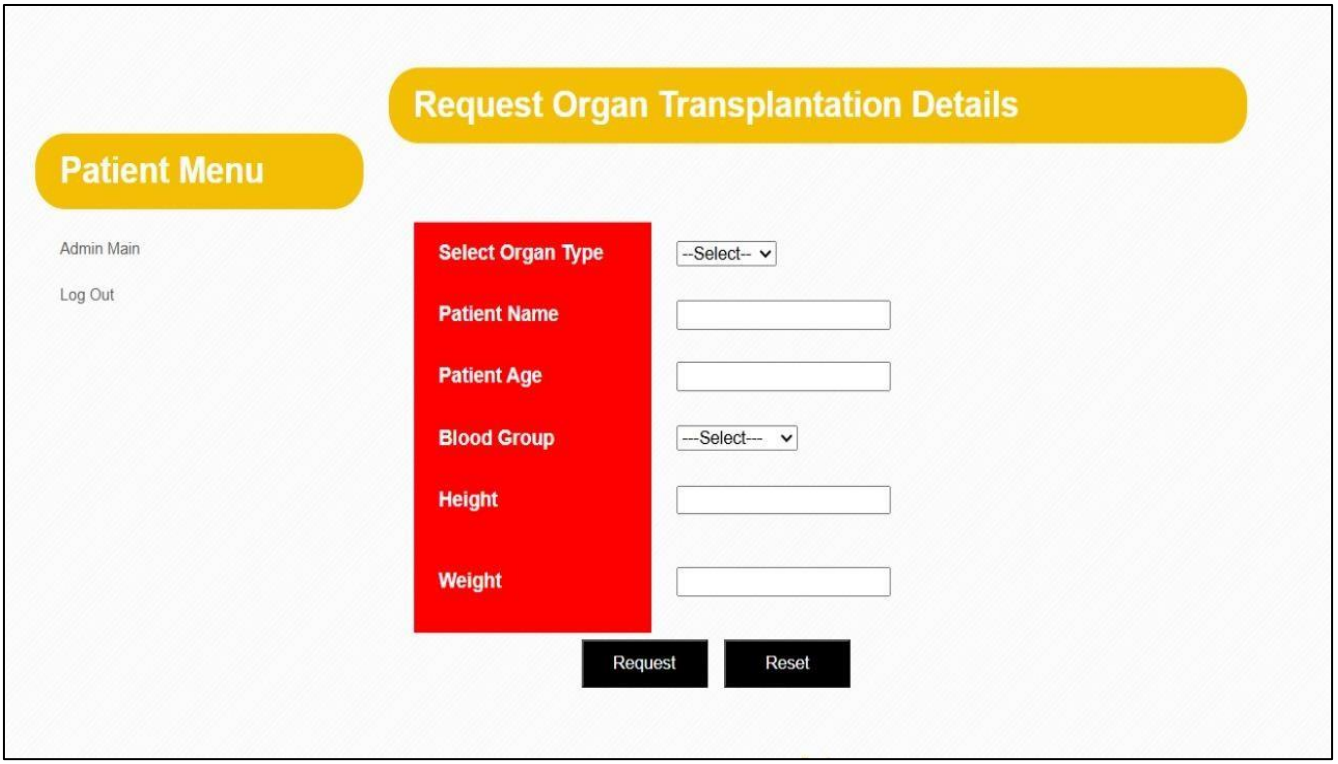

Fig -7: Patient Request Details

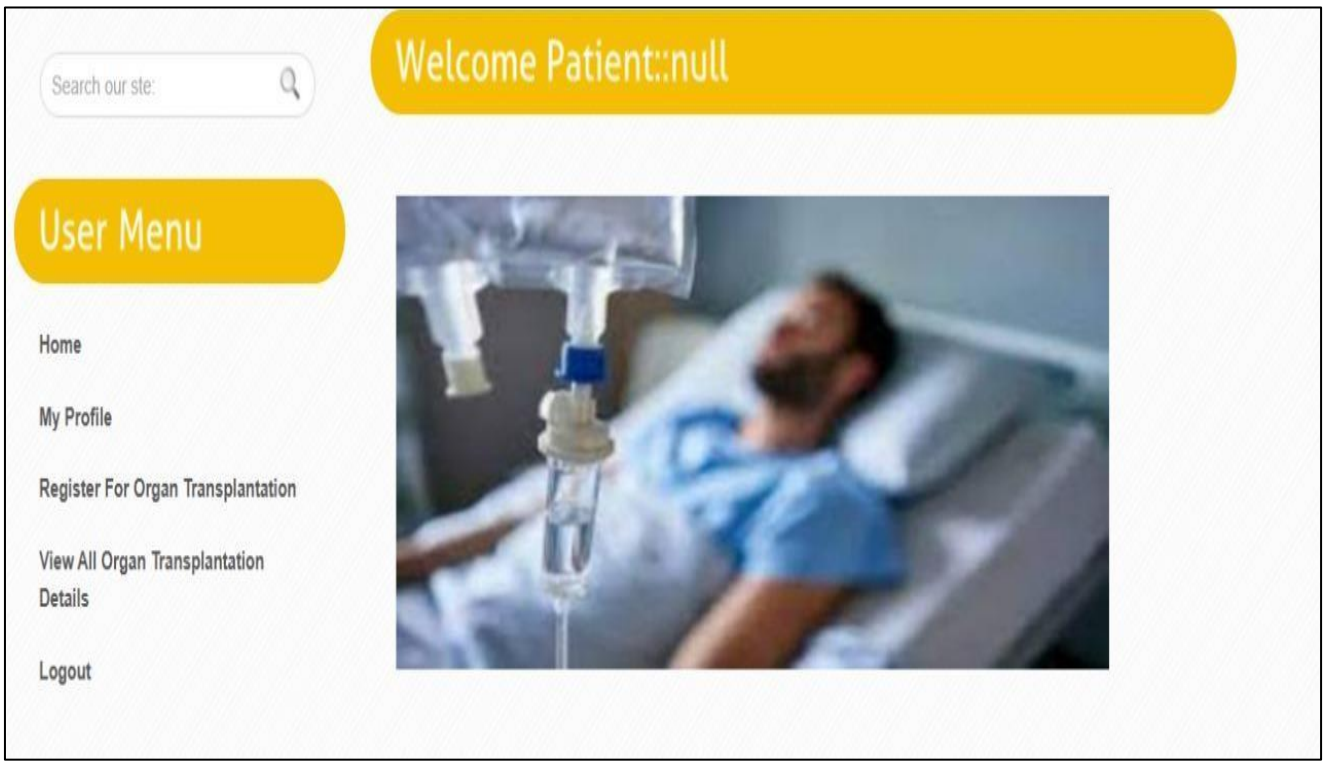

Fig-8: User Menu

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VII. CONCLUSION

This paper introduced a blockchain-based approach for managing the organ donation and transplantation lifecycle. The use of smart contracts enables event-driven data recording, improving system accountability and data integrity. We developed and validated algorithms to automate key operations and performed a thorough analysis to confirm the system's resistance to potential threats. Comparative results show that our approach enhances transparency and can be tailored to meet the requirements of similar applications. Future enhancements may include a full-stack DApp integration and deployment on a private Ethereum consortium network for enhanced confidentiality and scalability.

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