The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

Real-Time Donation Tracking System Using Blockchain Technology for Transparent and Secure Philanthropy

Sandip Nayak[1*], M Sharmila Devi[2], KVS China Perraju [3], Mohammed Shoaib[4], K Shankar[5], CH Durga Rao[6]
[1,2,3,4] Student, Dept of CSE, Nadimpalli Satyanarayana Raju Institute of Technology, Visakhapatnam, Andhra Pradesh-India
[5] Associate professor, Dept of CSE, Nadimpalli Satyanarayana Raju Institute of Technology, Visakhapatnam, Andhra Pradesh-India
[6] Assistant professor, Nadimpalli Satyanarayana Raju Institute of Technology, Visakhapatnam, Andhra Pradesh-India
Corresponding Author *: reachsandipn@gmail.com

Abstract

The Donation Tracking System is a cutting-edge software solution designed to transform how charitable organizations handle donations. It ensures transparency and accountability by using Ethereum blockchain to maintain an immutable ledger of transactions. Donors can securely contribute through various channels, track their contributions in real-time, and verify the authenticity of organizations. Nonprofits benefit from streamlined processes and real-time analytics, while beneficiaries receive fair and efficient aid distribution. Overall, this system represents a significant leap in transparency, efficiency, and trust in philanthropy, encouraging increased participation in charitable activities.

Keywords:
Blockchain, Ethereum, Transparency, Smart Contracts, Security, Decentralized.

1. Introduction

The current landscape of charitable donations is often plagued by issues of mistrust, lack of transparency, and inefficiency in fund distribution. Donors are frequently uncertain about how their contributions are utilized, which discourages further participation. Additionally, the absence of an immutable record leads to potential misuse of funds and difficulty in verifying the authenticity of organizations. Nonprofits, on the other hand, face challenges in efficiently managing donations and providing real-time accountability to stakeholders.

The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

The beneficiaries suffer due to unequal or delayed aid distribution, often resulting from inadequate tracking mechanisms. The Donation Tracking System addresses these challenges by leveraging Ethereum blockchain technology to create an immutable ledger of transactions, enabling real-time tracking, verification, and ensuring transparency for all parties involved. By providing a secure, efficient, and trustworthy platform, this solution aims to bridge the gap between donors, nonprofits, and beneficiaries, ultimately encouraging increased participation in charitable activities. To address this, our project aims to develop an REALTIME DONATION TRACKING SYSTEM.

The key objectives of the project include:

1. Ensure Transparency in entire system using backend which is powered by blockchain
2. Real time Transactions happening between different parties involved will be shown to users.
3. Those persons who are donating for the campaign will be shown to users, and those chose to maintain anonymity will be given the choice.
4. All the platform fees and marketing expenses will be shown to customers. Such that the users get an real life estimate, how much amount the fundraiser will receive.
5. The hospital or fundraiser will be required to submit the documents and estimated amount required instead of the users submitting the medical documents

This project is designed to balance accuracy and transparency, providing a user-friendly experience while maintaining security and ensure tamper free records of Transactions, making the digital crowdfunding optimal from rest of its counterparts.

2. Literature Survey

In [1], the authors present a system that comprises different user categories, namely donors. These individuals or organizations are active participants within the blockchain network, and each possesses an exclusive 160-bit account address. Using this address, they can access their accounts and execute transactions, with each transaction being securely authorized through their 256-bit private key.

In [2], A novel donation tracking model was introduced, incorporating additional participants to oversee the donation process and enhance transparency in charitable activities. The innovation aimed to eliminate doubts or suspicions regarding charitable organizations. The key feature of

this model was its ability to trace all donations on the blockchain, providing donors with clear insights into the utilization of their funds. To bring this concept to life, the proposed model was put into practice using Hyperledger Composer.

In [3] Sergey et.al present a system where the registration of charitable donations and fund transfers is facilitated via a REST API. Additionally, the system incorporates a Telegram bot that engages with users during the donation creation process. This bot allows users to specify the donation amount for charity and provides them with a unique donation ID. Users can then use this ID to access detailed information about the donation, either through the website or within the Telegram bot, to track the exact utilization of the funds. The bot's functionality closely aligns with that of the website.

In [4]: Give Track by Bit Give Foundation: Give Track is one of the pioneering blockchain-based donations tracking systems. It allows donors to trace their contributions and monitor the progress of charitable projects in real-time. The Bit Give Foundation has successfully employed blockchain technology to enhance transparency and accountability in the charitable sector.

In [5]: Aid Coin is a blockchain platform designed to track donations transparently. It utilizes smart contracts to ensure that donated funds are directed to the intended projects and causes. Aid Coin has partnered with various charitable organizations to implement blockchain technology for donation management.

In [6]: The system, built by the authors, categorizes users into Donors, Organizations (Beneficiaries), and General Users. Beneficiaries create fundraising requests, specifying target amounts and timelines. Donors can contribute funds through the platform, with the amount held in a smart contract until the target is met or the time expires. If successful, the funds are transferred to the beneficiary; otherwise, they are returned to the donors. The use of Ethereum blockchain ensures transparency, security, and scalability, offering donors a transparent view of their contributions while avoiding the risks of centralized systems.

In [7]: The authors have built smart contracts as self- executing agreements coded in languages like Solidity, primarily used with Ethereum, enabling automated, trustless transactions. They have designed Solidity as a contract oriented language similar to JavaScript, supporting features like inheritance, libraries, and security measures to prevent flaws. The authors have also developed and tested smart contracts in environments like Remix IDE, compiling them using

tools like solc. For deployment, they have connected to private blockchains via web3.js, setting up a connection to the blockchain node. MetaMask, as described by the authors, allows users to add custom RPC networks, create accounts, and interact with private blockchain nodes..

In [8]: The authors describe blockchain as a secure, transparent, and immutable decentralized ledger disrupting industries like payments and healthcare. They highlight Ethereum as a platform enabling peer-to-peer transactions and smart contracts without a central authority, using Ether as its cryptocurrency. Solidity is presented as a language for creating smart contracts on Ethereum, supporting features like inheritance. Smart contracts ensure secure, transparent transactions, with Solidity regularly updated for improvements..

In [9]: The authors have built a decentralized platform using Ethereum, focusing on creating secure digital technologies and cryptocurrency (ETH). They envision Web3 as the next phase of the internet, emphasizing decentralization and blockchain integration. With features like scalability, flexibility, and enhanced security, Ethereum supports their project. For the Genuine Charity App, they utilized Solidity Smart Contracts, web3, and ganache-cli for testing and deployment. The app can be deployed on the Rinkeby Test Network and developed with a React template for the frontend..

In [10]: In this paper the authors has build secure and transparent blockchain-based crowdfunding and charity apps, developers rely on advanced tools like Solidity for writing smart contracts and Truffle Suite, which offers a complete environment for development, testing, and deployment. Ganache, part of Truffle, provides a private blockchain for simulating Ethereum applications. Remix IDE simplifies smart contract creation with a browser-based environment. These tools enable testing under real-world scenarios, ensuring speed, security, and robustness for nonprofit applications.

3. Methodology

A blockchain-based virtual fundraising box serves as the core mechanism. Donations are stored in an escrow contract, which ensures funds are released to the recipient only when specific conditions are met. All transactions are processed through a single, authorized payment gateway for enhanced security and traceability

The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

4. Experimental Setup and Implementation

4.1 Donation Process

1. Campaign Creation by NGOs/Recipients

NGOs or recipients can create campaigns on the platform by providing essential details such as the campaign's purpose, required funds, and payment information. These details are displayed for donors to review.

2. Campaign Browsing by Donors

Once registered and logged in, donors can browse available campaigns and select one to support. The platform displays the campaign details, including the recipient's information and intended use of funds.

3. Verifying Authority Uploading Essential Documents

Instead of Fundraiser submitting the respective Documents. An Gateway will be made where Verified Hospitals are responsible for submitting the required documents and providing an estimated amount for the campaign, rather than placing this burden on individual users. This ensures a more streamlined and user-friendly experience, reducing the effort for donors while maintaining the authenticity and accuracy of the campaign. By verifying and centralizing the documentation process, the platform enhances trust and transparency, ensuring that funds are allocated for genuine causes. This approach also simplifies the donor's role, allowing them to focus solely on supporting verified campaigns. This ensures documents Uploaded on the system are Tamper Proof.

4.2 Donation Workflow

1. Fund Campaign:

Donors select a campaign and click the "Fund Campaign" button, entering the amount to donate in ETH currency.

5. MetaMask Integration

Donors log in to their Metamask accounts using their private keys. The Ethereum wallet displays the total amount to be donated, including gas fees.

6. Transaction Confirmation

After confirming the payment, a success message is displayed. The donation is stored in an escrow contract and not directly transferred to the campaign's wallet.

4.3 Escrow and Payment Gateway System

1. Escrow Contract Mechanism

- Donations are mapped to the campaign’s wallet address via the smart contract.
- The total donation balance is tracked but remains inaccessible to the campaign.

The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

4.4. Fund Utilization:

- To utilize funds, the campaign must use the provided payment gateway.
- The smart contract includes a function: pay(receiver address, vendor address, amount). This function transfers the specified amount to the vendor and deducts it from the campaign's balance.

4.5. Transaction Steps:

- The campaign administrator provides payment detail o After entering details, the administrator clicks "TRANSFER ETH" to proceed.
- A MetaMask pop-up prompts for transaction approval. Upon confirmation, the funds are transferred, and the button displays "Transferred."

4.6. Gas Fees:

- Gas fees are deducted from the campaign's wallet balance, while the vendor receives the full transferred amount.

4.7. Balance Updates:

- After successful transactions, the remaining balance is updated on the campaign's profile page.

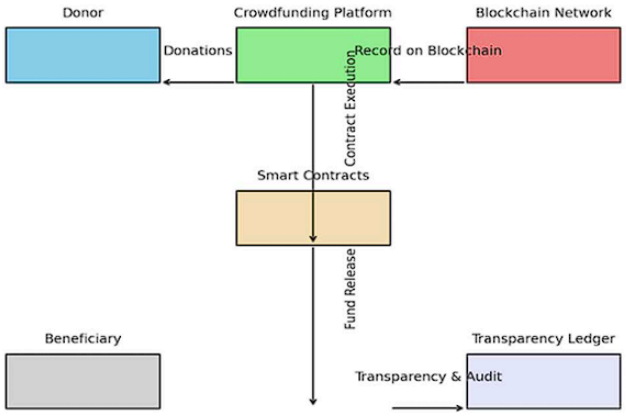


Fig 1. Flow Graph

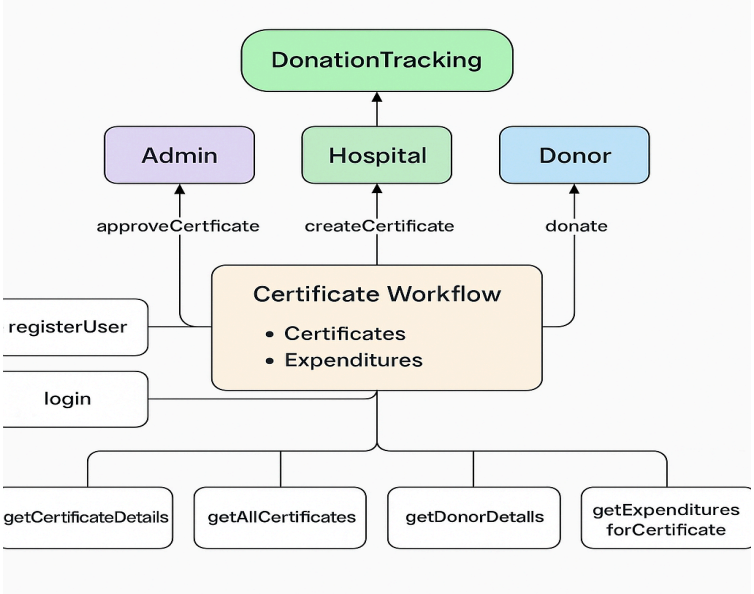
4.8. Transaction History Access:

- After donating, donors can access the campaign's transaction history. Non-donors attempting to access this data will receive an alert: "Not a donor." This feature is enabled by a smart contract that maps the donor's wallet address to the campaign's wallet address, verifying donation status.

The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

5. Diagrams and Figures

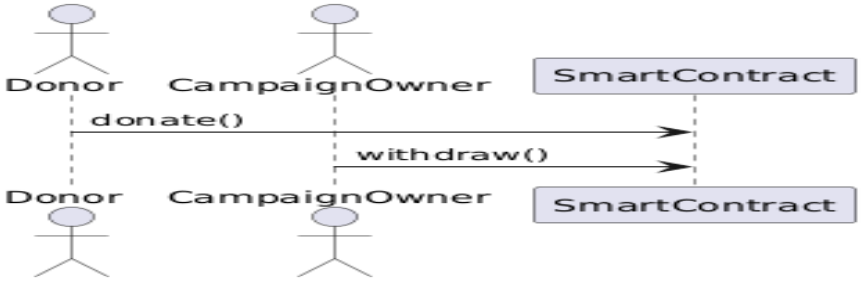
5.1 Visual Flow



This flowchart shows how the Donation Tracking system works:

1. Users (Admin, Hospital, Donor) interact with the system in different roles.
2. Hospitals create certificates for patients needing funds.
3. Admins approve these certificates.
4. Donors donate funds to approved certificates.
5. The system also lets users track donations, spending, and certificate details through view functions.

5.2 Smart Contract Design



\1. Actors in the System

a) Donor

The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

- **Role:** A donor is an external actor who wants to contribute funds (in Ethereum) to active donation campaigns.
- **Interaction:** The donor interacts with the SmartContract by invoking the donate() function.
- **Responsibilities:**

  Select a campaign from the frontend interface,Connect to a crypto wallet (e.g., MetaMask),Authorize the Ethereum transaction.

- **Security:** All donations are processed through the blockchain, ensuring tamper-proof and transparent transactions.

b) Campaign Owner

- **Role:** A campaign owner is an individual or organization that creates and manages donation campaigns.
- **Interaction:** The campaign owner interacts with the SmartContract by:
  Calling createCampaign() (though not shown in the arrow interactions in the UML, it's part of the contract's capabilities).
- **Security & Trust:**

Funds are locked in the smart contract and cannot be accessed until proper conditions are met.

Withdrawal logs are stored on the blockchain for transparency.

2. The SmartContract Class

The SmartContract class represents the decentralized application (DApp) logic deployed on the Ethereum blockchain using Solidity. It contains three key public functions that define the behavior of the donation platform.

a) createCampaign()

- **Purpose:** Enables a campaign owner to register a new fundraising campaign.
- **Parameters:** Typically includes campaign name, description, funding goal, and duration.
- **Functionality:**

Assigns a unique ID to the campaign.
Stores all campaign metadata in a struct or mapping on-chain.
Prevents duplication and invalid data.

- **Access Control:** Only accessible by the campaign creator**.**

The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

- **On-chain Storage:** Maintains campaign status, raised funds, donors, and owner address.

b) donate()

- **Purpose:** Allows a donor to send ETH to a specific campaign**.**
- **Process:** Donor initiates a transaction from the frontend through MetaMask,the donate() function validates the campaign status (e.g., active, not expired),ETH is transferred and locked in the smart contract.
- **Benefits:** No intermediaries—funds go directly from the donor's wallet to the contract,immutable transaction record on the blockchain.
- **Logging:** Emits DonationReceived events for frontend real-time updates.

3. Arrows and Relationships

- **Donor --> SmartContract : donate()**
  Indicates a unidirectional association where the donor triggers the donate() function on the smart contract. This action changes the blockchain state by transferring ETH and updating campaign statistics.
- **CampaignOwner --> SmartContract : withdraw()**
  Shows a unidirectional association where the campaign owner calls the withdraw() function to retrieve ETH. The smart contract checks all internal conditions before authorizing this withdrawal.

5.3 System Architecture

The architecture of the Real-Time Donation Tracking Website follows a client-server model with blockchain integration. The main components of the architecture include:

- **Client-Side (Frontend):**
  Built using React.js to ensure a dynamic and responsive user interface (UI).
  Allows users to browse active campaigns, make donations, track their contributions, and view updates in real time.
  Displays data fetched from the blockchain (such as donation amounts, campaign status, etc.) via backend APIs.
- **Smart Contract Layer:**
  Smart contracts are written in Solidity and deployed on the Ethereum blockchain.

The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

Smart contracts define the donation flow, enforce rules such as fund distribution, and trigger real-time updates to the campaign organizers and donors.

These contracts ensure the integrity and transparency of every transaction on the platform.

- **Backend (Blockchain Network):**

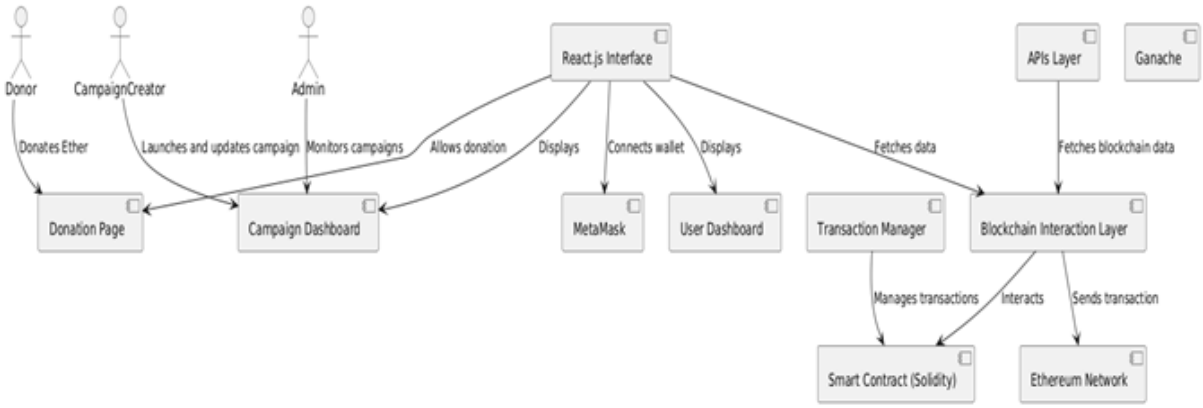
  Ganache serves as a local Ethereum blockchain network for testing and development, allowing the smart contracts to interact with the blockchain.

  Truffle is used to deploy and manage smart contracts on both local and public Ethereum networks.

  MetaMask integrates the blockchain with the frontend, acting as a bridge for wallet management and transaction signing.

- **Transaction Layer:**

  Ethereum's native cryptocurrency, Ether (ETH), is used for making donations. The integration of MetaMask allows for smooth and secure transactions by providing a digital wallet for managing Ether and interacting with smart contracts.

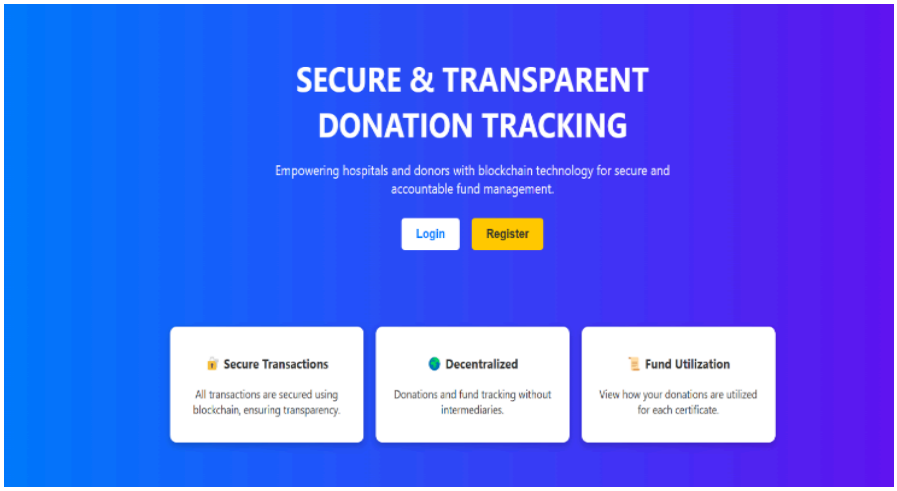


The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

6.5 Dashboards

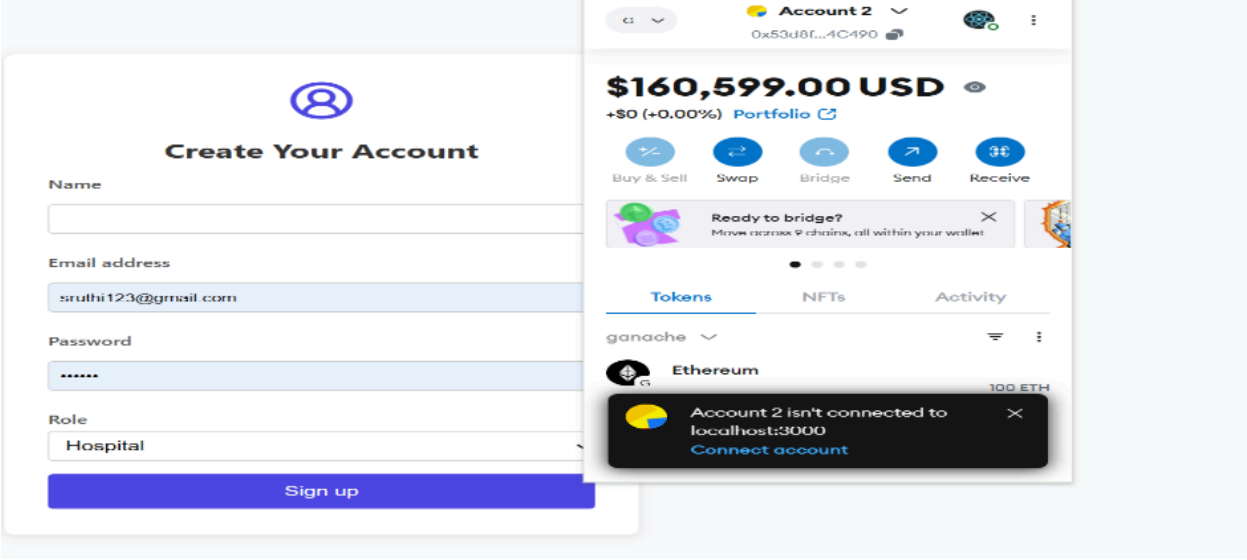
1- LANDING PAGE

The landing page is where the admin, hospital and the donar will sign up themselves and sign in themselves for proceeding themselves to do their respective tasks.



2-REGISTRATION PAGE

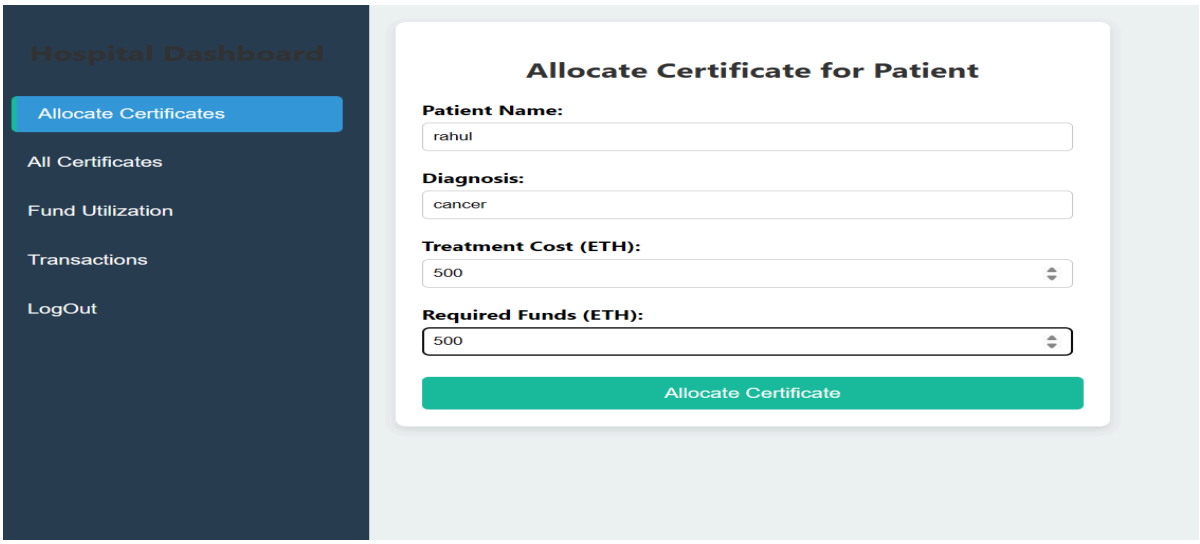
Here the admin, hospital and the donor can register themselves into the platform.



The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

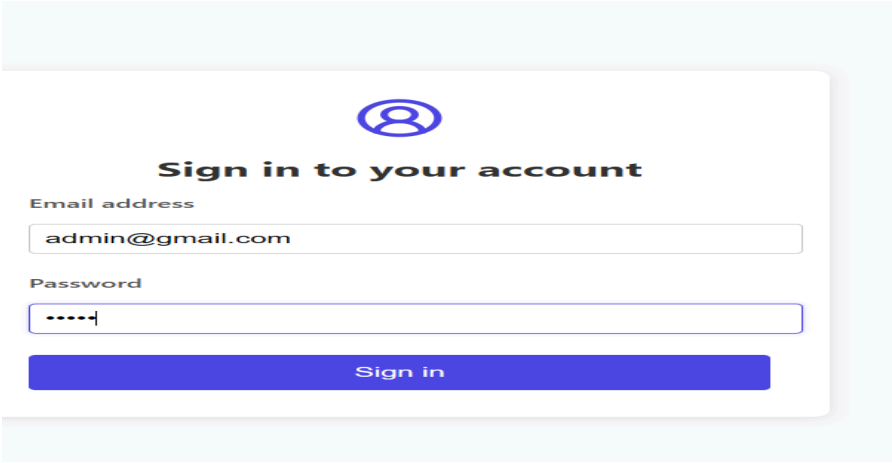
3-HOSPITAL REGISTERING THE PATIENTS

Hospital will be required to register the patients, with patient name, diagnosis and treatment cost, the funds which will be required. The hospital will then create a certificate for the patient, which will be used for the further process.



4-LOGIN PAGE

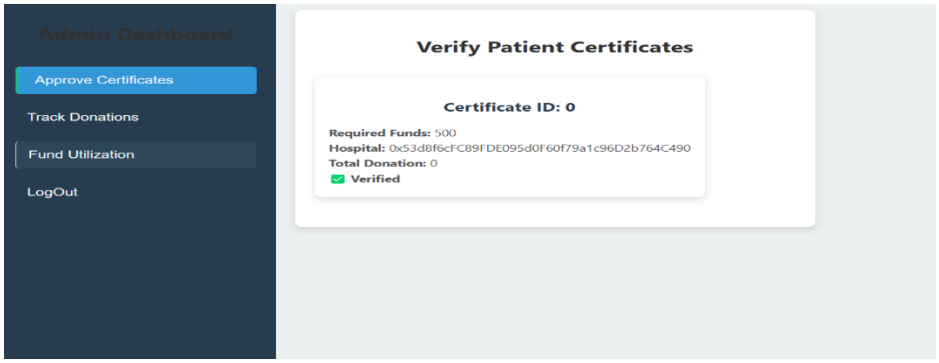
Here the admin, hospital, donor will sign in , they will be required to have their metamask account ready before logging in which will aid in logging themselves **for using the platform.**



The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

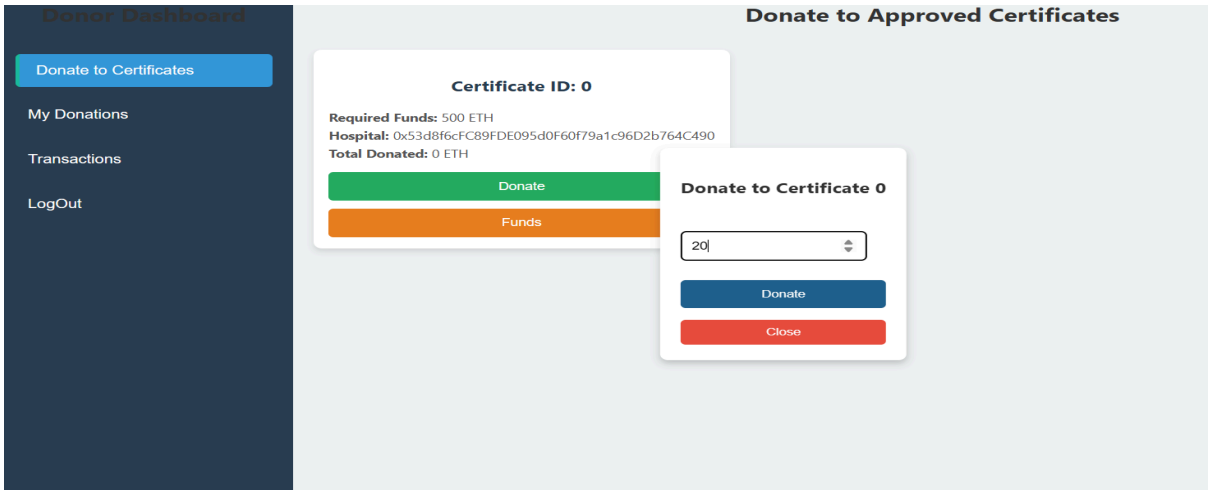
5- VERIFICATION AND APPROVAL OF THE CERTIFICATE BY THE ADMIN

After admin sign in into the platform using his designated log in credentials, where he has got the powers to list or de-list the fundraiser into the platform. If admin decides to approve the patient fundraiser. He will click on verify button, if he doesn't approves the fundraiser it will not be listed on the platform



6- DONAR DASHBOARD

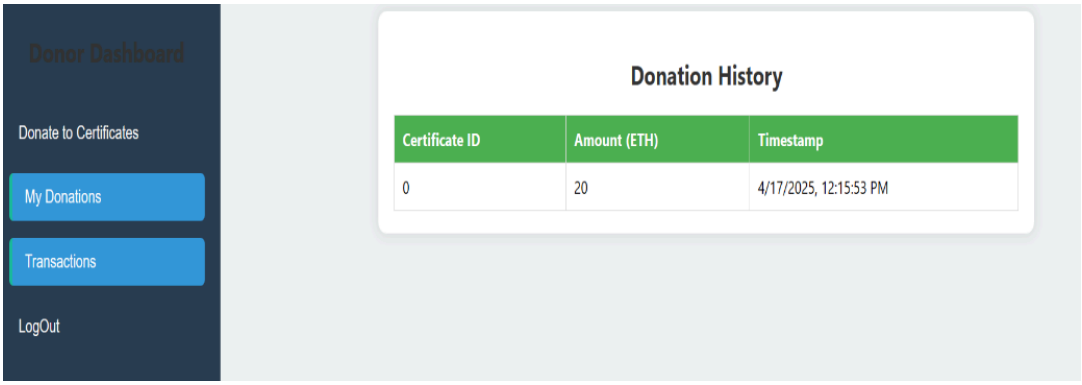
The donor will be able to see the approved fundraiser along with their certificate id's. If he choses to donate then a metamask pop-up will ask them to approve the transaction.



The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

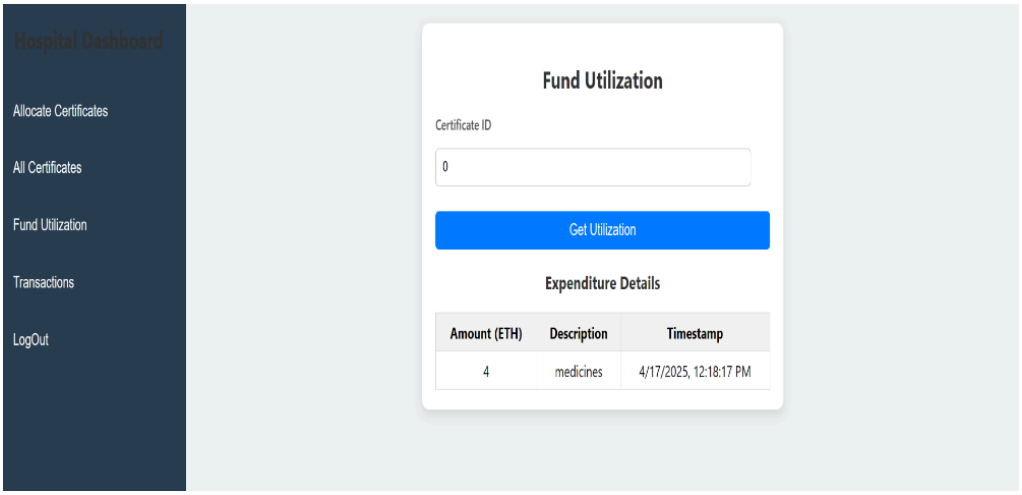
7- DONATION HISTORY

The donor will be able to see their donations in the donation history section



8- FUND UTILIZATION - HOSPITAL DASHBOARD

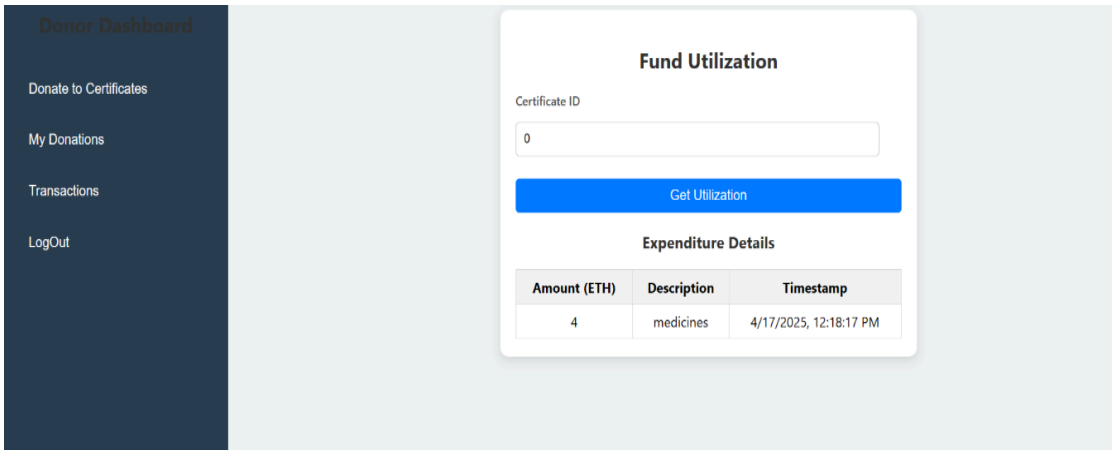
In the hospital dashboard, the hospital will be able to list their expenditures which will show the following details, amount utilized, description, timestamp.



The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

9- FUND UTILIZATION - DONOR DASHBOARD

The donor will be able to see the funds expenditures in the his fund utilization dashboard.



6 Result Analysis

The result analysis involves the performance evaluation focused on measuring key system metrics such as transaction processing time, gas consumption, UI load time, and concurrent handling capability. Testing was done on a local Ganache blockchain, with scalability tests planned for testnets like Rinkeby or Polygon Mumbai. Below Table 1. Is results analysis based on the implementation of the methodology described earlier.

Table 1. Performance Metrics

Parameter	Measured Value	Remarks
Average Transaction Time	3.5 seconds	Good performance for test environment
Gas Consumption per Txn	~45,000 gas	Optimized through compact Solidity code
UI Response Time	< 1.3 seconds	Quick frontend rendering
Max Simultaneous Users	20 (local)	Can scale using testnet or mainnet services

Performance was deemed efficient, with the system exhibiting low latency, moderate gas usage, and real-time rendering capabilities.

The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

Table 2. Security Evaluation Report

Security Risk	Testing Approach	Outcome
Unauthorized Withdrawal	Access controlled by ownership	Prevented via require()
Frontend Input Injection	Form validation + sanitization	No XSS or injection issues
Reentrancy Attack on Withdraw	Simulated nested call attempts	Protected using checks-effects-interactions pattern
Transaction Replay	Nonce-based transaction IDs	Replay prevented

The system was found to be secure and resilient against known attack vectors common in Ethereum smart contracts.

Conclusion

In conclusion, the blockchain-based decentralized donation tracking system offers a significant leap forward in enhancing transparency, security, and trust in the charitable donation process. By utilizing Ethereum blockchain technology and smart contracts, this system ensures that every donation is securely recorded and can be publicly verified, eliminating concerns of fraud or misuse of funds. Donors can track their contributions in real-time, fostering a sense of confidence and accountability, while campaign creators can provide transparent updates and manage funds according to predefined rules. Despite challenges such as transaction delays and fluctuating gas fees, the system shows great promise in revolutionizing the charitable sector. With future enhancements might be , integrating Layer 2 solutions to improve scalability and transaction speed, and expanding accessibility through mobile app development, Expanding the system to support multiple cryptocurrencies or even fiat currencies could make it more versatile, especially for international donors. While Ethereum is a strong candidate for blockchain-based donations, integrating with other blockchain platforms, such as Binance Smart Chain (BSC), Polka dot, or Solana, could reduce costs and offer more flexibility for users in different regions.
This donation platform has the potential to reshape how charitable giving is approached globally. The system's ability to offer secure, transparent, and real-time tracking of donations makes it a valuable tool for increasing donor trust, broadening the reach of fundraising campaigns, and ensuring that donations are used for their intended purpose. Ultimately, this blockchain-driven solution has the potential to enhance participation and foster a more trustworthy, efficient, and impactful philanthropic ecosystem.

The Journal of Computational Science and Engineering (TJCSE)
ISSN 2583-9055 (Media Online)
Vol 3, No 7, July 2025
PP 23– 39

References

1. A. Singh, R. Rajak, H. Mistry and P. Raut, "Aid, Charity and Donation Tracking System Using Blockchain," 2020 4th International Conference on Trends in Electronics and Informatics (ICOEI) (48184), 2020, pp. 457- 462, Doi: 10.1109/ICOEI48184.2020.9143001
2. E. Shaheen et al., "A Track Donation System Using Blockchain.' 2021 International Conference on Electronic Engineering (ICEEM), 2021, pp. 1-7, doi: ICEEM52022.2021.9480649
3. Avdoshin, Sergey & Pesotskaya, Elena. (2021). Blockchain in Charity: Platform for TrackingDonations. 10.1007/978-3-030-63089-8_45.
4. https://www.bitgivefoundation.org/
5. https://www.aidchain.co/
6. Prof. Sumit Shevtekar, Ajay Raut, Pranit Chaudhari "Fundraising Tracking System Using Blockchain" On 18 Nov 2022 International Journal of Scientific Research in Computer Science, Engineering and Information Technology
7. Vishwanath Hiremath, Parth Shaha, Shubham Wandhekar, Pratik Namdas, Prof. K.S.Patil "Decentralised Application on Charity Using Blockchain" On May 2023 International Journal for Research in Applied Science& Engineering Technology (IJRASET)DOI:10.22214/ijraset.2023. 51648
8. Purva Deepak Patil, Dikshita Jaiprakash Mhatre, Nidhi Hemant Gharat, Jisha Tinsu" Transparent Charity System using Smart Contracts on Ethereum using Blockchain" 2022 In International Journal for Research
9. Deepika Nadar,Dheeraj Pandey,Prinsu Tiwari,Sushil Yadav "A Platform for Tracking Charity Donation Using Blockchain" On March 2023 International Journal of Scientific Research in Engineering and Management (IJSREM) DOI:10.55041/ijsrem18348
10. Mr. Pramod S. Aswale, Mrs. Nishigandha Vyawahare, Abhijeet Patange, Prathamesh Hargude"Transparent Charity Application and Crowdfunding Using Blockchain" In 2024 International Research Journal on Advanced Engineering Hub (IRJAEH) DOI:10.47392/irjaeh.2024.0168