A Project Report

On

A Dynamic Donation Allocation and Validator Accountability Mechanism For Effective Charity Process Using Blockchain Technology

Submitted to

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTHAPUR, ANANTHAPURAMU

In Partial Fulfillment of the Requirements for the Award of the Degree of

BACHELOR OF TECHNOLOGY

In

COMPUTER SCIENCE AND TECHNOLOGY

Submitted By

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This is to certify that the B. Tech Project Work & Internship(20CST703) report titled, **"A Dynamic Donation Allocation and Validator Accountability Mechanism For Effective Charity Process Using Blockchain Technology"** submitted by **Y.MOHAN KUMAR (21691A2893), A.PRRADEEP KUMAR (21691A28C1), N.PRASANTH REDDY (21691A28C6), P.PURUSHOTHAM (21691A28D1)** has been evaluated using Anti-Plagiarism Software, Turnitin and based on the analysis report generated by the software, the report's similarity index is found to be 14%.

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ABSTRACT

Emergencies like pandemics and natural disasters demand a global response to aid affected communities, but traditional charity systems often lack transparency, deterring donors due to concerns about fund misuse. Blockchain technology (BCT), particularly the Ethereum blockchain, provides a transformative solution by enabling secure, traceable, and immutable transactions without intermediaries. Donors can track their contributions, ensuring transparency and accountability. **A Dynamic Donation Allocation and Validator Accountability Mechanism** is proposed, integrating smart contracts with a hybrid consensus model. The system introduces a reputation-based validator mechanism that evaluates and manages the trustworthiness of nodes, preventing malicious activities and ensuring reliability. By combining automated fund disbursement through smart contracts and secure validation using advanced consensus protocols, this solution bridges gaps in transparency, efficiency, and trust. It enhances resource allocation, reduces fraud, and ensures timely aid delivery, ultimately rebuilding donor confidence and supporting recovery efforts.

Keywords: *Blockchain, Ethereum, Smart Contracts, Dynamic Fund Allocation, Validator* ReputationSystem,Transparency,Security,CharityPlatforms

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LIST OF ABBREVIATIONS

BC	Blockchain
ETH	Ethereum
SC	Smart Contracts
POS	Proof of Stake
POA	Proof of Authority
HCP	Hybrid Consensus Protocol
DAPP	Decentralized Application
TX	Transaction
EVM	Ethereum Virtual Machine
DAO	Decentralized Autonomous Organization
P2P	Peer-to-Peer
GUI	Graphical User Interface
TX HASH	Transaction Hash
UML	Unified Modelling Language
ER	Entity-Relationship Model
DFD	Data Flow Diagram
RAM	Random Access Memory

CHAPTER - 1

INTRODUCTION

1.1 About Blockchain Technology

Blockchain is a revolutionary technology that enables secure, transparent, and decentralized transactions. At its core, it is a distributed ledger where data is recorded in "blocks" that are linked together in a chain, creating an immutable record. Unlike traditional databases, blockchain does not rely on a central authority. Instead, it operates across a network of computers, or nodes, each maintaining a copy of the ledger. This ensures that the data is transparent, as every participant can verify the information, and secure, as altering any data requires changing it across all copies of the ledger, which is nearly impossible. Blockchain has a wide range of applications, from powering cryptocurrencies like Bitcoin to ensuring the integrity of supply chains, voting systems, and even healthcare data. Its decentralized nature eliminates the need for intermediaries, reducing costs and increasing efficiency. Blockchain is considered the backbone of a new era of trust and digital transformation in various industries.

➢ **Applications of Blockchain:**

- **Charity:** Ensures transparent and direct donations to the right causes.
- **Banking and Finance:** Makes transactions faster, cheaper, and more secure.
- **Voting Systems:** Provides safe, tamper-proof online voting.
- **Supply Chain Management:** Tracks products from origin to delivery with full transparency.
- **Cryptocurrency:** Powers digital currencies like Bitcoin and Ethereum.
- **Healthcare:** Protects patient data and ensures secure medical records.
- **Real Estate:** Simplifies property sales and ownership records.

1.2 Challenges & issues in Charity :

Charitable donation platforms, especially those based on traditional or early blockchain systems, face a range of challenges that impact their trustworthiness and effectiveness. Many existing solutions that adopted either Proof of Authority or Proof of Stake alone struggled to balance transparency, decentralization, and efficiency. While PoA systems offered speed, they often lacked decentralization, placing too much control in the hands of a few validators. On the other hand, Proof of stake systems provided better decentralization but sometimes suffered from slower transaction speeds and scalability issues. In addition to these technical limitations, real-time fund tracking, clear verification mechanisms, and strong fraud prevention tools. High administrative overhead, delays in fund distribution, and limited accessibility further discouraged donor participation. These ongoing problems reduce public trust and prevent donations from reaching the people who need them most, highlighting the need for a more balanced and reliable solution

1.3 Motivation

The motivation for a blockchain-driven charity donation system lies in its potential to revolutionize transparency, trust, and efficiency in disaster relief and philanthropic efforts. By leveraging decentralized technology, such as smart contracts and immutable ledgers, donations can be tracked in real-time, ensuring that funds are allocated securely and reach the intended beneficiaries without intermediaries. This enhances donor confidence, reduces the risk of fraud, and streamlines resource distribution. Additionally, blockchain facilitates the creation of a centralized database to record past disaster histories, improving response strategies and public awareness. Ultimately, the goal is to foster a more accountable and transparent donation ecosystem, ensuring that aid reaches those in need efficiently while promoting trust and collaboration among stakeholders.

1.4 Problem Definition

To implement a secure and transparent donation management system using blockchain technology to overcome the challenges of traditional charitable platforms. The system should utilize smart contracts and decentralized ledgers to enable real-time tracking of funds, giving donors full visibility into how their contributions are allocated and used. By reducing reliance on centralized entities, this approach minimizes risks such as fund mismanagement and corruption, fostering greater accountability and trust. Additionally, automated validation mechanisms will ensure that funds are distributed according to predefined rules, holding intermediaries accountable and maximizing aid efficiency. Ultimately, the goal is to create a fair, transparent, and impactful donation ecosystem that strengthens donor confidence and ensures resources reach those in need.

1.5 Objectives of the Project

- The objective of a blockchain-powered donation management system is to enhance transparency, security, and efficiency in charitable transactions. By leveraging decentralized ledger technology and smart contracts, the system ensures that donations are tracked
- Through immutable record-keeping, every transaction remains tamper-proof, eliminating risks of fraud and mismanagement while fostering greater trust among donors and

beneficiaries. The decentralized nature of blockchain prevents any single entity from exerting control over the system, ensuring fairness and reducing the chances of data manipulation.

1.6 Scope of the Project

The scope of this blockchain-based donation management system focuses on transforming the way charitable contributions are tracked, managed, and distributed. Firstly, it involves designing a decentralized platform that ensures transparency, security, and accountability in donation transactions. This includes the development of smart contracts to automate fund allocation and enforce predefined rules, eliminating the risk of misuse or fraud . Secondly, the system integrates an immutable ledger to record all transactions permanently, allowing donors, beneficiaries, and organizations to verify the flow of funds in real-time. Additionally, it aims to enhance user experience by providing intuitive dashboards and analytics tools, enabling stakeholders to monitor donation trends, impact metrics, and fund utilization effortlessly. Furthermore, the project seeks to support a wide range of charitable initiatives, from disaster relief efforts to long-term social programs, ensuring scalability and adaptability across different use cases. By implementing a hybrid consensus protocol, the system also aims to optimize transaction speed while maintaining robust security . Ultimately, the project’s scope includes ongoing refinements to improve efficiency, reduce operational costs, and build greater trust in the donation process. By leveraging blockchain’s capabilities, the system aspires to create a more transparent, efficient, and reliable framework .

CHAPTER - 2

LITERATURE SURVEY

2.1 Blockchain Technology on Charity Donation

The Blockchain technology is transforming the way charitable donations are managed, making the process more transparent, secure, and trustworthy. Traditional donation systems often struggle with issues like fund mismanagement, fraud, and a lack of accountability. Blockchain addresses these challenges by providing a decentralized, tamper-proof ledger that records every transaction in real time. With the use of smart contracts, funds can be automatically distributed based on predefined conditions, reducing reliance on intermediaries and ensuring that donations reach the intended recipients. s literature review explores recent developments in blockchain-powered charity systems, highlights the challenges faced in implementation, and discusses potential future improvements to enhance efficiency and donor confidence.

➢ **RELEVANT TERMINOLOGIES**

- **Blockchain:** Blockchain is a form of decentralized ledger technology (DLT) that spreads data across multiple computers in a network. Once recorded, transactions or data entries are securely time-stamped and cannot be altered, ensuring transparency and reliability. To keep the records consistent across all participants, blockchain relies on consensus mechanisms. This makes it especially useful in sectors like charitable donations, where maintaining trust through transparency is essential.

- **Ethereum:** Ethereum is a publicly accessible blockchain platform built to support the creation and execution of decentralized applications (Dapps) and smart contracts. Operating on a distributed network, it enables users to engage in transactions directly, eliminating the need for middlemen. Its capability to handle complex processes efficiently makes it ideal for applications requiring a high degree of transparency, such as automated systems for tracking donations.

- **Smart Contracts:** Smart contracts are self-executing digital agreements designed to trigger actions automatically once predefined conditions are met. These agreements have their terms embedded in code, enabling secure and transparent transactions without relying on intermediaries. This not only enhances automation but also reduces the risk of fraud or manipulation. In the context of charitable donations, smart contracts ensure that funds are disbursed only when certain criteria, such as achieving a fundraising goal, are fulfilled.

- **Hybrid Consensus Protocol:** A Hybrid Consensus Protocol blends two validation methods: Authority-Based Verification and Stake-Based Validation. In the stake-based approach, validators secure the network and confirm transactions by holding a certain stake. Meanwhile, the authority-based model relies on trusted entities to validate transactions, enhancing efficiency and scalability.

2.2 Related Work

Blockchain technology has gained attention for its ability to improve trust and transparency in different areas, including charitable donations. Many earlier studies focused on the problems with traditional donation systems, such as lack of accountability, misuse of funds, and difficulty in tracking how donations are used. These studies helped to show how blockchain can be used to solve such issues by recording all transactions securely and making them visible to everyone involved. Later research built on these ideas by suggesting ways to use blockchain to directly connect donors with beneficiaries, remove middlemen, and use smart contracts to automatically handle fund transfers. Several researchers have explored how blockchain technology can be leveraged to enhance transparency and trust in charitable donations.

"Blockchain-Oriented Effective Charity Process During Pandemics and Emergencies" by **Mandeep Kaur** et al. proposes a blockchain-based framework using Ethereum and smart contracts to manage crisis donations by eliminating intermediaries and ensuring secure, traceable transactions. The system enhances transparency, privacy, and real-time fund tracking, aiming to reduce costs and mitigate fraud. Key metrics include transparency, security, privacy, and traceability. Its strengths lie in transparency and eliminating intermediaries, while it faces challenges related to scalability limitations and energy efficiency due to its Proof-of-Authority (PoA) consensus.

"Enhancing Donor Trust Through a Blockchain Based Traceability Model for Charitable Contributions" by **Andry Alamsyah** et al. introduces a blockchain-powered traceability model to build trust in charitable donations by providing end-to-end tracking from donors to beneficiaries. The model improves transparency, accountability, and supports tax deduction processes with future plans for Dapp integration. It uses metrics such as transparency, immutability, and traceability. The key advantage is increased donor trust and improved accountability, while the main drawback is the complexity of implementation.

"Fund Tracking System Using Blockchain Technology" by **Anupama B** et al. explores a blockchain-based fund tracking system built on Ethereum that enhances transparency and accountability in managing relief funds through real-time transaction tracking with smart contracts. It boosts stakeholder trust and aims for future integration with public ledgers. The system is evaluated on transparency and efficiency metrics. Benefits include high transparency and secure data integrity, while drawbacks involve high energy consumption and computational cost.

"**A Platform for Tracking Charity Donations**" by Suraj Sahani et al. details the development of a blockchain-based platform designed to improve transparency, accountability, and donor trust in charitable giving by addressing issues such as fraud and fund mismanagement. The platform securely records all donation transactions using blockchain for traceability. Key metrics are transparency and traceability. Its main advantages are improved transparency and donor trust, whereas scalability remains a major concern.

"Crowdfunding Charity Platform Using Blockchain" by **Dr. S. Saranya** et al. presents a blockchain-based crowdfunding system using Ethereum, integrating smart contracts and features like an auto pool circle program to support secure and transparent charitable transactions. It aims to minimize fraud, reduce transaction fees, and provide tax benefits while fostering donor trust. The system emphasizes metrics such as transparency, security, and decentralization. Advantages include immutability and a decentralized structure, whereas it suffers from high transaction fees and limitations in scalability and efficiency.

"Decentralized Fundraising Application Using Blockchain" by **Rishi Dange** et al. proposes a decentralized platform leveraging blockchain and smart contracts to ensure secure, transparent financial transactions, enhanced by a machine learning-powered recommendation engine and cryptocurrency support for global use. Designed to streamline fundraising, it improves accessibility and reliability. Key metrics include security and transparency. It offers enhanced transparency and secure transactions, but is heavily dependent on the blockchain infrastructure.

"Trustful Charity Foundation Platform Based on Hyperledger Fabric" by **Artem Barger** et al. outlines a blockchain-based charity platform built on Hyperledger Fabric to ensure transparency, trust, and efficient fund allocation. It uses the immutability and traceability of blockchain to prevent fraud and lets donors monitor their contributions in real-time. The primary metrics are increased transparency and enhanced trust. While the platform builds donor confidence, it faces challenges like high resource requirements and limited decentralization.

"Karma - Blockchain Based Charity Foundation" by **Gubaev Renat** et al. introduces the Karma platform using Hyperledger Fabric, enabling transparent and trustworthy charitable donations through secure, traceable transactions and real-time tracking. It uses smart contracts for managing funds, addressing fraud and inefficiency in donations. Trust and transparency are the key evaluation metrics. The platform improves donor trust and transaction clarity, though it ironically suffers .

"A Secured Distributed Ledger Based Fundraising Framework Using Smart Contracts" by **Darshan MSR** et al. presents a blockchain-based crowdfunding platform utilizing smart contracts to ensure transparency, security, and traceability in charitable donations. The system promotes donor trust by offering incentives like tax benefits and rewards, addressing key challenges in transparency and accountability. Key evaluation metrics include traceability and immutability. The framework enhances donor trust and system accountability, though its adoption is limited in regions with poor internet connectivity.

"Blockchain and Its Implementation for Charitable Organizations" by **Iqra Khalil** et al. introduces a blockchain-driven solution for charitable organizations using Ethereum's Proof-of-Authority (PoA) and smart contracts to ensure secure, tamper-proof transactions. It provides real-time tracking, automated donor updates, and transparent fund distribution to combat fraud and inefficiency. Metrics such as transparency, decentralization, and immutability are emphasized. While it offers high transparency and trust, its scalability is constrained due to network limitations.

"A Track Donation System Using Blockchain" by **Eisa Shaheen** et al. proposes a decentralized blockchain system to improve transparency, trust, and cost efficiency in donations through secure, trackable smart contract transactions. Key features include immutable transaction logs, real-time tracking, and detailed donor reports, addressing mismanagement and enhancing accountability. The system focuses on metrics such as transparency, trust, and efficiency. Benefits include secure data handling and user privacy, while high implementation complexity remains a significant drawback.

"Aid, Charity, and Donation Tracking System Using Blockchain" by **Aashutosh Singh** et al. outlines a decentralized donation system on Ethereum integrating smart contracts, tokenized contributions, and real-time tracking to ensure transparent, corruption-resistant transactions between donors, NGOs, and governments. With metrics like improved efficiency, transparency, and decentralization, the system supports traceability and secure transfers. Advantages include reduced corruption and increased security, but transaction gas fees and the rigid immutability of blockchain pose challenges.

"Developing a Reliable Service System of Charity Donation During the COVID-19 Outbreak" by **Hanyang Wu** et al. presents a blockchain-based donation system designed for crisis scenarios like COVID-19, focusing on enhancing transparency, trust, and efficiency. Utilizing smart contracts on a decentralized and tamper-proof blockchain, it supports secure, traceable transactions, real-time fund tracking, and project monitoring. The system employs metrics such as transparency, privacy, and traceability. It eliminates intermediaries and improves fund visibility, though it faces scalability and energy efficiency limitations under the Proof-of-Authority (PoA) consensus.

“Proposed Solution for Trackable Donations using Blockchain” by **N. Sai Sirisha** et al**.** introduces "Charity-Chain", a blockchain-enabled donation platform built on Ethereum, integrating smart contracts and IPFS to secure and trace donations while involving multiple stakeholders like charities and government bodies. It aims to boost transparency and accountability with metrics like traceability and transaction integrity. Advantages include secure engagement and high data visibility, though high computational and gas costs along with limited adoption in low-connectivity areas present drawbacks.

“Platform for Tracking Donations of Charitable Foundations Based on Blockchain Technology” by **Hadi Saleh** et al. discusses a blockchain-based donation tracking platform supported by a Russian government initiative to ensure donor trust and transparency. Built on Ethereum with smart contracts and centralized storage, it supports automated reporting, donor notifications, and fraud prevention. Key metrics include tracking integrity and transparency. While it offers high security and accountability, the platform suffers from limited scalability due to its hybrid storage approach.

2.3 Literature Survey

S. No	Year &Journal	Title	Author	Metrics	Advantages	Disadvantages
1	2024	"Blockchain Oriented Effective Charity Process During Pandemics and Emergencies"	"Mandeep Kaur, et al."	Transparency , security, Privacy, Traceability.	Transparency Traceability, Eliminates Intermediaries .	Proof of-Authority (PoA) Scalability Limitations, Energy Efficiency
2	2024	"Enhancing Donor Trust Through a Blockchain Based Traceability Model for Charitable Contributions"	"Andry Alamsyah et al."	Transparency , immutability, traceability	Increased donor trust, Improved transparency and accountability	Implementation n complexity,
3	2023	"Fund Tracking System using Blockchai n Technology"	"Anupama B et al".	Transparency ,Efficiency	High transparency, Secure data integrity	High energy consumption, High computational cost
4	2023	"A Platform for Tracking Charity Donations"	"Suraj Sahani e t al."	Transparency , Traceability	Improved transparency, Trust	Scalability Issues
5	2022	"Crowdfunding Charity Platform Using Blockchain"	"Dr.S.Saranya, et al."	Transparency , Security	Immutability , Decentralize d structure	High Transaction Fees, Scalability and Efficiency
6	2022	"Decentralized Fundraising Application Using Blockchain"	"Rishi Dange et al."	Security, Transparency	Enhanced transparency, Secure transactions	Dependency on blockchain infrastructure
7	2022	"TrustfulCharity Foundation platform based on Hyperledger Fabric"	"Artem Barger et al	Increased Transparency ,Enhanced Trust	Builds trust and transparency	High resource requirements, Limited decentraliaion
8	2021	"Karma -Blockchain Based Charity Foundation	"Gubaev Renat et al."	Trust, Transparency	Improved transparency, Trust	Lack of Transparency
9	2021	"A Secured Distributed Ledger Based Fundraising Framework Using Smart Contracts"	"Darshan MSR et al."	Traceability, Immutability	Increased transparency and accountabilit y in charity systems, Enhanced trust factor for donors	Limited reach in regions with low internet penetration
10	2021	"Blockchain and ItsImplementationfor Charitable Organization's "	"Iqra Khalil et al."	Transparency Decentralization	Immutability High transparency	Limited Scalability,

S. No	Year &Journal	Title	Author	Metrics	Advantages	Disadvantages
11	2021	“A Track Donation System Using Blockchain	“Eisa Shaheen et al.”	Transparency , trust, efficiency	User privacy, High transparency, Secure data integrity	High Implementatio n Complexity
12	2020	“Aid, Charity, and Donation Tracking System Using Blockchain”	“Aashutosh Singh et al.”	Improved efficiency, Transparenc y	Transparency, Traceability, Security, Reduced Corruption, Decentralization	Gas Fees for Transactions, Immutability Challenges
13	2020	““Developing a Reliable Service System of Charity Donation During the Covid -19 Outbreak”	““Hanyang al.” Wu et	Transparency , security, Privacy, Traceability .	Transparenc y Traceability, Eliminates Intermediari es.	Proof of-Authority (PoA) Scalability Limitations, Energy Efficiency
14	2019	“ Proposed Solution for Trackable Donations using Blockchain"	N.Sai Sirisha et al.	transparency, traceability.	High computation al costs , gas costs.	Limited reach in regions with low inter net penetration ,
15	2019	“"Platform for Tracking Donations of Charitable Foundations Based on Blockchain Technology"	Hadi Saleh et al.	transparenc y, trust, tracking integrity	High transparency, Secure data integrity	Limited Scalability

2.4 Challenges in Charity

Charitable donation platforms, especially those based on traditional or early blockchain systems, face a range of challenges that impact their trustworthiness and effectiveness. Many existing solutions that adopted either Proof of Authority or Proof of Stake alone struggled to balance transparency, decentralization, and efficiency. While PoA systems offered speed, they often lacked decentralization, placing too much control in the hands of a few validators. On the other hand, Proof of stake systems provided better decentralization but sometimes suffered from slower transaction speeds and scalability issues. In addition to these technical limitations, these systems often lacked real-time fund tracking, clear verification mechanisms, and strong fraud prevention tools. High administrative overhead, delays in fund distribution, and limited accessibility further discouraged donor participation. These ongoing problems reduce public trust and prevent donations from reaching the people who need them most, highlighting the need for a more balanced and reliable

2.5 Summary

This literature review explores the growing role of blockchain in transforming charity donation systems, focusing on its ability to improve transparency, security, and efficiency. By utilizing smart contracts and decentralized frameworks, blockchain ensures real-time tracking of funds, reduces fraud, and builds donor confidence. These advancements address long-standing concerns in the charity sector, such as mismanagement of donations and lack of accountability.

Recent studies highlight the potential of hybrid consensus models like Proof of Stake (PoS) and Proof of Authority (PoA) to enhance transaction speed, scalability, and decentralization. Researchers have also explored blockchain-powered crowdfunding platforms, decentralized governance models (DAOs), and seamless integration with traditional banking systems to create more accessible and efficient donation processes.

However, challenges remain, including regulatory uncertainties, security vulnerabilities, and barriers to widespread adoption. Future innovations will likely focus on strengthening smart contract security, using AI for fraud detection, and improving donor engagement through user- friendly blockchain solutions. With continuous advancements, blockchain has the potential to revolutionize charitable giving, making donations more trustworthy, efficient, and impactful in addressing global humanitarian needs.

CHAPTER - 3

PROBLEM ANALYSIS

3.1 Existing System

- The Charity donation platforms today primarily depend on centralized financial institutions and third-party organizations to handle donations. These intermediaries manage fund transfers, verify NGOs, and oversee the distribution of funds. However, donors often have limited visibility into how their contributions are used, leading to trust issues and skepticism.

- Another major drawback is the slow and bureaucratic process involved in verifying NGOs and disbursing funds. Since transactions require manual approval at various levels, there can be significant delays in getting help to those in need.

- Moreover, high transaction fees imposed by banks and payment gateways reduce the actual amount reaching the beneficiaries. Security is also a concern, as centralized databases are vulnerable to cyberattacks, fraud, and data breaches, putting sensitive donor and NGO information at risk.

Disadvantages of Existing System

- **Lack of Transparency:** Donors have no way to track where their money is going, leading to doubts about fund utilization.

- **High Transaction Costs**: Processing fees charged by financial institutions eat into the donated amount.

- **Slow Processing Times:** Manual verification and bureaucratic delays slow down fund disbursement.

- **Security Risks:** Centralized databases can be hacked, leading to fraud and potential loss of funds.

3.2 Proposed System

- The To overcome these challenges, our blockchain-powered donation platform offers a transparent, decentralized, and secure alternative to traditional charity systems. By utilizing Ethereum-based smart contracts, donations are automatically processed and allocated without intermediaries, ensuring that funds directly reach the intended beneficiaries.

- With blockchain, every transaction is recorded on a public ledger, making it tamper-proof and fully transparent. Donors can track their contributions in real-time, verifying exactly how their money is being used. Smart contracts automate fund allocation based on predefined conditions, eliminating the risk of mismanagement or corruption.

- The platform also enables cryptocurrency-based donations, which provide fast, low-cost transactions compared to traditional banking systems. A decentralized identity verification system ensures that only legitimate NGOs can receive funds, reducing fraud risks.

Advantages over Existing System

- **Real-Time Transparency:** Every transaction is publicly recorded, allowing donors to track their funds and see their impact instantly.
- **Decentralized and Secure Transactions:** Removes intermediaries, reducing costs and ensuring that funds cannot be tampered with.
- **Fast and Low-Cost Processing:** Donations are processed almost instantly with minimal fees, making fund transfers more efficient.
- **Fraud Prevention and Security:** Uses blockchain-based identity verification and multi-signature wallets to prevent unauthorized fund withdrawals.
- **Scalability and Future Growth:** Can be expanded to support multiple cryptocurrencies, cross-border donations, and AI-driven analytics for smarter fund allocation.

3.3 System Specifications

3.3.1 Hardware Configuration

- **Processor** : AMD Ryzen 7 or Intel Core i9
- **Graphics Card** : Nvidia RTX 4090
- **Storage** : 160GB (SSD preferred)
- **Ram** : 8GB or 16GB DDR5 RAM

3.3.2 Software Configuration

- **Operating System** : Windows 7/8/10
- **IDE** : Remix IDE (for Smart Contract Development)
- **Libraries Used** : Web3.js, Ethereum.js, Truffle Framework
- **Technology** : Solidity, JavaScript, Node.js

3.3.3 Deployment Details of Registration Contract

Field	Value
Transaction Hash	0x9ac84e75301780c1112b4c8fb677c47d1b959ee13f0d5c15d1cdf51b63b023df
Block	2
Timestamp	Feb-19-2025 17:27:52
From	0x7761c624808c2cc1e450c3d81f16799f2fb9c55
To	0x2453c25555407b544dfc62cc07e5afe9e440d5
Gas used by Transaction	1,049,322

Table 1 Block 2 Creation Details

Field	Value
Transaction Hash	0x9ac84e75301780c1112b4c8fb677c47d1b959ee13f0d5c15d1cdf51b63b023df
Block	30
Timestamp	Apr-11-2025 01:32:52
From	0x7761c624808c2cc1e450c3d81f16799f2fb9c55
To	0x2453c25555407b544dfc62cc07e5afe9e440d5b
Gas used by Transaction	1,029,300

Table 2 Block 30 Creation Details

3.3.4 Functional Requirements:

Requirement analysis plays a key role in determining the effectiveness and success of a system by defining what it should accomplish. Functional requirements specify the core features and capabilities that the platform must provide, ensuring a seamless and efficient user experience.

These are requirements that the end user specifically demands as basic facilities that system offers. All these requirements needed necessarily incorporated into the system. They are basically the requirements stated by the user which one can see in the final product.

- User Authentication
- Smart Contract Execution
- Transaction Processing
- Real-Time Transparency
- NGO Verification

3.3.5 Non-Functional Requirements

These are basically the quality constraints that the system will satisfy according to the project. The priority to which these factors are implemented various from one perspective to other. They are also called non-behavioral requirements.

- Portability
- Performance
- Scalability
- Reliability
- Security
- User-friendly interface with navigations.

CHAPTER - 4

SYSTEM DESIGN

4.1 System Architecture

System Architecture Overview

The proposed system leverages blockchain technology to create a secure, transparent, and decentralized charity donation platform. It consists of three primary components:

- **User Interface (UI):** A web-based platform where donors, NGOs, and administrators can interact, make donations, and track how funds are utilized.
- **Blockchain Network:** Built on the Ethereum blockchain to ensure transparency, security, and immutability of transactions.
- **Smart Contract Execution:** Automates key processes, including fund allocation, transaction verification, and compliance enforcement, eliminating the need for intermediaries

Donation Processing and Verification

When a donor initiates a cryptocurrency donation, smart contracts ensure that funds reach verified NGOs efficiently and securely. The verification process includes:

- **Decentralized Identity Verification:** NGOs undergo blockchain-based authentication to prevent fraud and ensure credibility.
- **Smart Contract-Based Fund Allocation:** Donations are automatically disbursed based on predefined conditions, ensuring funds are used appropriately.
- **Immutable Transaction Logs:** Each transaction is permanently recorded on the blockchain, allowing real-time tracking of funds.

Ensuring Transparency and Security

Blockchain technology guarantees the security and transparency of all donation-related activities. Key mechanisms include:

- **Tamper-Proof Ledger:** All transactions are recorded immutably, preventing unauthorized modifications.
- **Multi-Signature Authentication:** Ensures that funds can only be withdrawn with multiple verified approvals, preventing misuse.
- **End-to-End Encryption:** Protects donor and NGO data from unauthorized access and cyber threats.

Real-Time Monitoring and Insights

- The system provides an interactive dashboard where donors and NGOs can monitor transactions, fund distributions, and impact reports. Key features include:

- **Live Donation Tracking:** Donors can track how their funds are being utilized in real-time.
- **Analytics and Reporting:** Insights into donation trends, fund efficiency, and NGO performance.
- **Automated Notifications:** Alerts for successful transactions, NGO verification updates, and fund disbursements.

Integration with Financial and Regulatory Frameworks

Integration with Financial and Regulatory Frameworks To ensure compliance with financial and legal requirements, the system incorporates:

- **Regulatory Compliance for Cryptocurrencies**: Ensures donations align with legal frameworks governing digital assets.
- **Governance via Smart Contracts:** Enforces transparency in fund management and usage.
- **Cross-Border Transactions:** Supports global donations with minimal transaction costs and high efficiency.

Scalability and Future Enhancements

The system is designed to evolve with advancements in blockchain and digital finance. Potential future improvements include:

- **Multi-Currency and Fiat Support**: Expanding to support multiple cryptocurrencies and fiat transactions.
- **Mobile Application Integration:** Offering seamless access to donations and fund tracking via smartphones

Expected Outcomes and Impact

The proposed system aims to blockchain-based charity donation platform is expected to:

- **Improve Transparency**: Every donation can be tracked from source to utilization.
- **Reduce Costs:** Eliminates third-party fees, ensuring more funds reach the intended beneficiaries.
- **Enhance Security:** Strong encryption, decentralized identity verification, and smart contract automation.
- **Boost Donor Confidence:** Donors receive verifiable proof of how their contributions are being used, strengthening trust in charitable organizations.

This system presents a modern approach to charity donations by leveraging blockchain technology to enhance transparency, security, and efficiency through smart contracts.

- **User Interaction:** Donors access a user-friendly web platform to make cryptocurrency donations, while NGOs and administrators use the system to manage and track fund allocations seamlessly.
- **Blockchain-Powered Transactions:** Every donation is recorded on the Ethereum blockchain, ensuring that transactions remain transparent, immutable, and tamper-proof. Smart contracts automate fund transfers, eliminating the need for intermediaries.
- **NGO Verification:** To prevent fraudulent activities, NGOs undergo a decentralized identity verification process before they can receive funds. Smart contracts further validate donations to ensure compliance with predefined rules.
- **Fund Distribution:** Donations are disbursed according to preset conditions within the smart contracts, ensuring that funds are used responsibly for their intended purposes.
- **Real-Time Transaction Tracking:** Every donation and fund transfer is permanently logged on the blockchain, allowing donors to monitor fund usage and verify transactions in real time.
- **Enhanced Security Measures:** Multi-signature authentication secures withdrawals, while end- to-end encryption safeguards donor and NGO data. The decentralized nature of blockchain ensures protection against tampering and fraud.
- **Monitoring & Analytics:** A dedicated dashboard provides donors and NGOs with transaction histories, fund tracking, and impact analysis, offering valuable insights into donation effectiveness.
- **Regulatory Compliance:** The system follows financial and legal regulations, ensuring secure cross-border transactions and adherence to cryptocurrency compliance standards.
- **Future Upgrades:** Planned improvements include multi-currency support, AI-driven fraud detection, and mobile app integration to enhance accessibility and user experience.
- **Impact & Benefits:** By ensuring full transparency, reducing transaction costs, strengthening security, and improving accountability, this blockchain-powered system builds trust and transforms the way charitable donations are managed and distributed. Normalization.

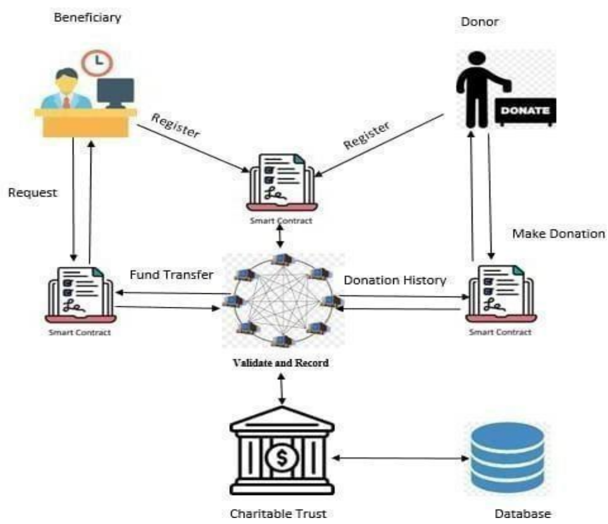


Fig. 4.1 System Architecture

In Fig. 4.1.1 the proposed system architecture, This blockchain-based charity donation system leverages smart contracts and a hybrid consensus mechanism combining Proof of Authority (PoA) and Proof of Stake (PoS). Donors and beneficiaries register via smart contracts, ensuring secure and transparent transactions. Donations are validated and recorded on the blockchain using the hybrid consensus approach, and funds are efficiently transferred to beneficiaries. A charitable trust oversees the records, which are securely stored in a database.

The blockchain-based charity donation system leverages Ethereum and smart contracts to ensure secure, transparent, and efficient fund transfers. Here's a breakdown of the key components and their roles:

- **Initiating a Donation:** Donors access the web platform to make cryptocurrency donations. The system collects donor details and transaction metadata, ensuring a seamless donation process.

- **Smart Contract Processing:** Once a donation is initiated, an Ethereum smart contract automatically verifies and processes the transaction. This ensures that funds are allocated according to predefined rules without requiring intermediaries.

- **NGO Verification:** To prevent fraud, NGOs must undergo decentralized identity verification using blockchain-based authentication before receiving donations.

- **Fund Distribution:** Smart contracts handle the secure transfer of funds, releasing them only when the necessary conditions are met, ensuring proper utilization for charitable causes.

- **Transaction Logging:** Every donation is permanently recorded on the blockchain, creating a transparent and tamper-proof history of all transactions for public verification.

- **Security Measures:** Multi-signature authentication is used to authorize fund withdrawals, adding an extra layer of security. Additionally, end-to-end encryption safeguards donor and NGO data from cyber threats.

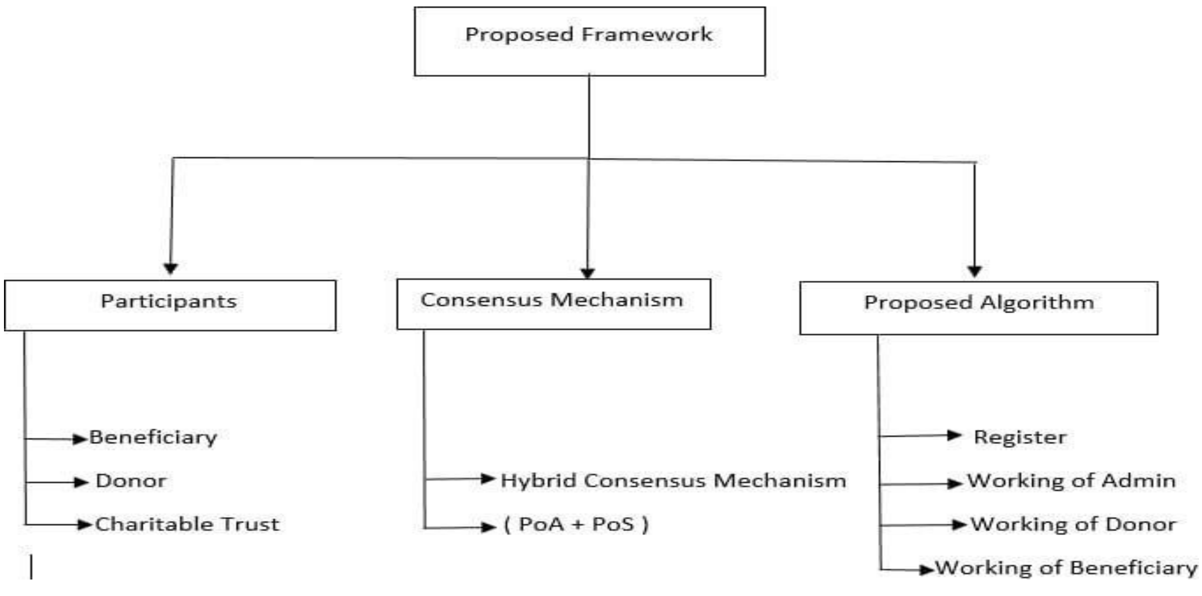
- **Real-Time Monitoring & Reporting:** Donors can track their contributions in real time through an interactive dashboard that provides insights into fund allocation, spending, and overall impact.

- **Impact & Benefits:** This system enhances trust by ensuring donations are used as intended, reduces transaction costs by eliminating intermediaries, and improves security through decentralized verification and transparent record-keeping

4.2 Methodology of Proposed Work

➢ **Problem Definition and Objectives**

Understand the Problem: Traditional charity donation systems often lack transparency, making it difficult for donors to track how their contributions are being used. Issues like mismanagement, fraud, and inefficient fund distribution can reduce donor trust. To address these challenges, we propose a blockchain-based donation platform that ensures security, transparency, and decentralized control over fund allocation.



4.2 Proposed Frame Work

Registration Algorithm Description

The Registration Algorithm is designed to securely onboard users by verifying their identity using a government-issued Unique Identification Number (UID). The process ensures that only authenticated individuals can participate in the system, whether as a Decentralized User or a Blockchain User.

Steps Involved:

- **UID Verification:**
  - The user initiates the registration by submitting their UID.
  - The system cross-checks the UID against the official government database (Dg).
- **Valid UID:**
  - **If the UID exists and is verified:**
  - The user is prompted to select a role: either a Decentralized User or a Blockchain User.
  - The system collects and registers the user's details (name, address, UID, and selected role).
  - **A unique system-generated ID is assigned:**
  - DID (for Decentralized Users)
  - BID (for Blockchain Users)
  - These details are securely recorded on the blockchain to ensure transparency and immutability.
- **Invalid UID:**
  - If the UID does not match any entry in the government database:
  - The system immediately terminates the process.
  - A message stating "Invalid Identity" is displayed to the user.
  - No ID is generated, and the registration is rejected.
  - This algorithm ensures that only verified and legitimate users are allowed to access the system, maintaining the integrity and security of the decentralized platform.

Admin Algorithm Description

The Admin Algorithm manages and monitors the activities within the blockchain network (BCN), including validating users, processing donations, and handling beneficiary requests. The algorithm ensures that all transactions and record updates are securely and transparently maintained on the blockchain.

Steps Involved:

1. **Admin Authentication:**
   - The Admin logs into the system using a valid login ID to gain access to the Blockchain Network (BCN).

2. **Donor Validation and Processing:**

- If the Donor's Decentralized ID (DID) is valid:
  - The donor is added to the blockchain.
- If the donor proceeds to make a donation:
  - Transaction records such as Transaction Record (Trc), Transaction Proof (Trp), and Timestamp (τc) are updated on the blockchain.
  - The system notifies the donor with a confirmation message.
- If the Donor's DID is invalid:
  - An "Invalid User" message is displayed.
  - Further processing for this user is stopped.

3. **Beneficiary Validation and Processing:**

- If the Beneficiary's Blockchain ID (BID) is valid:
  - The beneficiary is added to the blockchain.
  - Access is granted to relevant records, including BID, Beneficiary Record (BREC), Transaction Info (Tri), and User Request (Ureq).
- If the Beneficiary's BID is invalid:
  - A "User Not Found" message is displayed.
  - Further processing for this user is stopped.

4. **Beneficiary Request Handling:**

- If a beneficiary request (Ureq) is received and is valid:
  - The system checks if the corresponding Transaction Proof (Trp) exists on the blockchain.
  - If the transaction proof is valid:
    - The blockchain is updated with the latest Trc, Trp, and τc.
    - Beneficiary details in Tri are also updated.
  - If the transaction proof is invalid:
    - An error message is displayed.
    - The process is terminated for this request.

This algorithm ensures secure user validation, real-time monitoring, proper recording of donations, and efficient handling of beneficiary transactions, thereby upholding the integrity and trust of the blockchain-based system.

Beneficiary Algorithm Description

The Beneficiary Algorithm is designed to allow verified beneficiaries to interact with the blockchain system, view their records, and request financial assistance. The process continuously monitors beneficiary actions and ensures that only authenticated users can access the system.

Steps Involved:

1. **Beneficiary Identification:**
    - The beneficiary initiates the process by entering their Blockchain ID (BID) into the system.
2. **Continuous Monitoring:**
    - The system operates in a loop, continuously checking beneficiary actions until manually stopped.
3. **BID Validation:**
    - The system checks whether the entered BID exists in the Blockchain Network (BCN).
4. **If BID is Valid:**
    - The system updates the beneficiary's record (BREC) as needed.
    - It retrieves and displays the beneficiary's details, including:
        - BID (Blockchain ID)
        - BREC (Beneficiary Record)
        - Tri (Transaction Information), which may contain name, address, and UID.
    - The beneficiary can then send a request to the Admin for financial help or support.
5. **If BID is Invalid:**
    - The system displays a "User Not Found" message.
    - The user is prompted to register in the system to gain access.
    - The process then repeats, waiting for valid input.

This algorithm ensures that only verified beneficiaries can access sensitive information and request assistance, maintaining both security and usability in a decentralized environment.

Beneficiary Algorithm Description

The Beneficiary Algorithm is designed to allow verified beneficiaries to interact with the blockchain system, view their records, and request financial assistance. The process continuously monitors beneficiary actions and ensures that only authenticated users can access the system.

Steps Involved:

1. **Beneficiary Identification:**
    - The beneficiary initiates the process by entering their **Blockchain ID (BID)** into the system.
2. **Continuous Monitoring:**
    - The system operates in a loop, continuously checking beneficiary actions until manually stopped.
3. **BID Validation:**
    - The system checks whether the entered **BID** exists in the **Blockchain Network (BCN)**.
4. **If BID is Valid:**
    - The system updates the beneficiary's record (**BREC**) as needed.
    - It retrieves and displays the beneficiary's details, including:
        - **BID** (Blockchain ID)
        - **BREC** (Beneficiary Record)
        - **Tri** (Transaction Information), which may contain name, address, and UID.
    - The beneficiary can then **send a request to the Admin** for financial help or support.
5. **If BID is Invalid:**
    - The system displays a **"User Not Found"** message.
    - The user is prompted to **register** in the system to gain access.
    - The process then repeats, waiting for valid input.

This algorithm ensures that only verified beneficiaries can access sensitive information and request assistance, maintaining both security and usability in a decentralized environment.

Donor Algorithm Description

The Donor Algorithm facilitates secure interaction between donors and the blockchain system. It allows verified donors to view their information and contribute donations, while ensuring unregistered users are prompted to register.

Steps Involved:

1. **Donor Identification:**
   - The donor begins the process by entering their **Decentralized ID (DID)** into the system.
2. **Continuous Monitoring:**
   - The system operates in a continuous loop, constantly checking for donor actions until manually stopped.
3. **DID Validation:**
   - The system checks whether the provided **DID** exists in the **Blockchain Network (BCN)**.
4. **If DID is Valid:**
   - The system updates the donor's records (**DREC**) as necessary.
   - It retrieves and displays the donor's complete details, including:
     - **DID** (Decentralized ID)
     - **DREC** (Donor Record)
     - **Tri** (Transaction Information), containing personal data like name, address
   - The donor is then **allowed to make a donation**.
5. **If DID is Invalid:**
   - A **"User Not Found"** message is displayed.
   - The donor is prompted to **register** in the system before proceeding.
   - The system continues running and waits for valid input.

This algorithm ensures that only authenticated donors can interact with the donation system, securely update their information, and perform transactions on the blockchain.

- **Blockchain Setup**

Ethereum and Smart Contract Development:

Use Ethereum blockchain to ensure all transactions are secure, transparent, and tamper-proof. Develop smart contracts that automatically manage donations, ensuring funds reach the right recipients based on predefined conditions.

- **Transaction Ledger:**:
  - Record every donation transaction on the Ethereum blockchain, making the process completely auditable and resistant to fraud.
  - Use IPFS (InterPlanetary File System) for storing additional details like donation receipts and fund usage reports securely.

- **Donation Process:**

- **User Registration:**
  - Donors and NGOs register on the platform using a decentralized identity verification system to ensure authenticity.
  - A verification mechanism is implemented to prevent fraudulent NGOs from misusing the platform.

- **Making a Donation:**
  - Donors can browse verified NGOs and make donations using cryptocurrency (ETH or other tokens).
  - Smart contracts automatically handle fund allocation based on predefined rules, ensuring that donations are used appropriately.

- **Tracking Fund Utilization:**
  - NGOs update their fund utilization reports through blockchain transactions, allowing for real-time transparency.
  - Donors can track exactly where their money is going using publicly available

- **Deployment of Smart Contracts:**
  - Develop and deploy Solidity-based smart contracts to automate fund transfers.
  - Implement functions for donation processing, fund withdrawal, and maintaining transaction logs.

- **Integration with Web and Mobile Interfaces**

- **Decentralized Application (DApp) Development:**
  - Build a user-friendly web and mobile interface where donors can make donations, track funds, and view NGO activities.
  - Use Web3.js to connect the frontend with the Ethereum blockchain for seamless transactions.

- **Real-Time Data Monitoring:**
  - Display live donation statistics using interactive data visualization tools.
  - Allow donors to track their contributions through blockchain explorers, ensuring complete transparency

➢ **Results and Evaluation**

- **A Security and Transparency:**
  - Conduct rigorous testing of smart contracts to identify and fix vulnerabilities.
  - Validate the authenticity and transparency of donation records stored on the blockchain.

- **Performance and Scalability:**
  - Optimize transaction processing times and minimize gas fees for efficient blockchain operations
  - Assess the system's ability to handle a large number of users and transactions

➢ **Summary**

By leveraging blockchain technology, smart contracts, and decentralized control, this system offers a secure, transparent, and fraud-resistant platform for charity donations. Donors can contribute with confidence, knowing that their funds are being utilized as intended. The real-time tracking mechanism ensures accountability, revolutionizing how charitable contributions are managed and building greater trust in the nonprofit sector

4.3 UML Design

Unified Modelling Language is a general-purpose modelling language that is widely used in object-oriented software engineering. The standard is produced and managed by the Object Management Group. The goal is for object-oriented software modelling to become more widely used and for UML to become a standard language. The notation and the meta-model are the two primary components of UML as it is currently implemented. Additional UML-related procedures or techniques may be added in the future.

Unified Modelling Language is one language that is frequently used to define, display, and discuss data. constructing and documenting artefacts related to software systems in addition to business modelling and non-software systems. Many best engineering practices have been used to effectively execute large and complex system models; these practices are compiled in the UML.

Throughout the software development life cycle, the UML is crucial for creating object-oriented software. Graphical notation is the main tool used by the UML to depict software project design.

Goals

The following are the main objectives of the UML design:

- Enable users to develop and share useful models by providing them with an expressive, user-friendly visual modelling language.
- Provide instruments for customization and scalability to broaden the core concepts.
- Remain insensitive to certain programming languages and development methods.
- Provide a well-organized framework for understanding the modelling language.
- Support higher level development concepts such as partnerships, frameworks, components, and patterns.
- Provide best practices for the industry.

4.3.1 Use case Diagram

A use case diagram, a type of behavioral diagram in Unified Modeling Language (UML), is crafted through use-case research to visually depict a system's functionality. It employs actors, their goals (articulated as use cases), and the relationships among those use cases. The primary aim is to illustrate which actors interact with the system and the tasks they undertake. Use case diagrams succinctly portray the roles of actors within the system, facilitating comprehension of system functionality at a glance. Through the diagram, stakeholders can grasp the system's intended behaviors and understand how various actors engage with it.

tools for communication and requirements analysis in software development projects. They offer a high-level view of system functionality, aiding in the identification of user needs and system requirements. Thus, use case diagrams play a pivotal role in system design and development processes, guiding the creation of effective and user- centric software solutions.

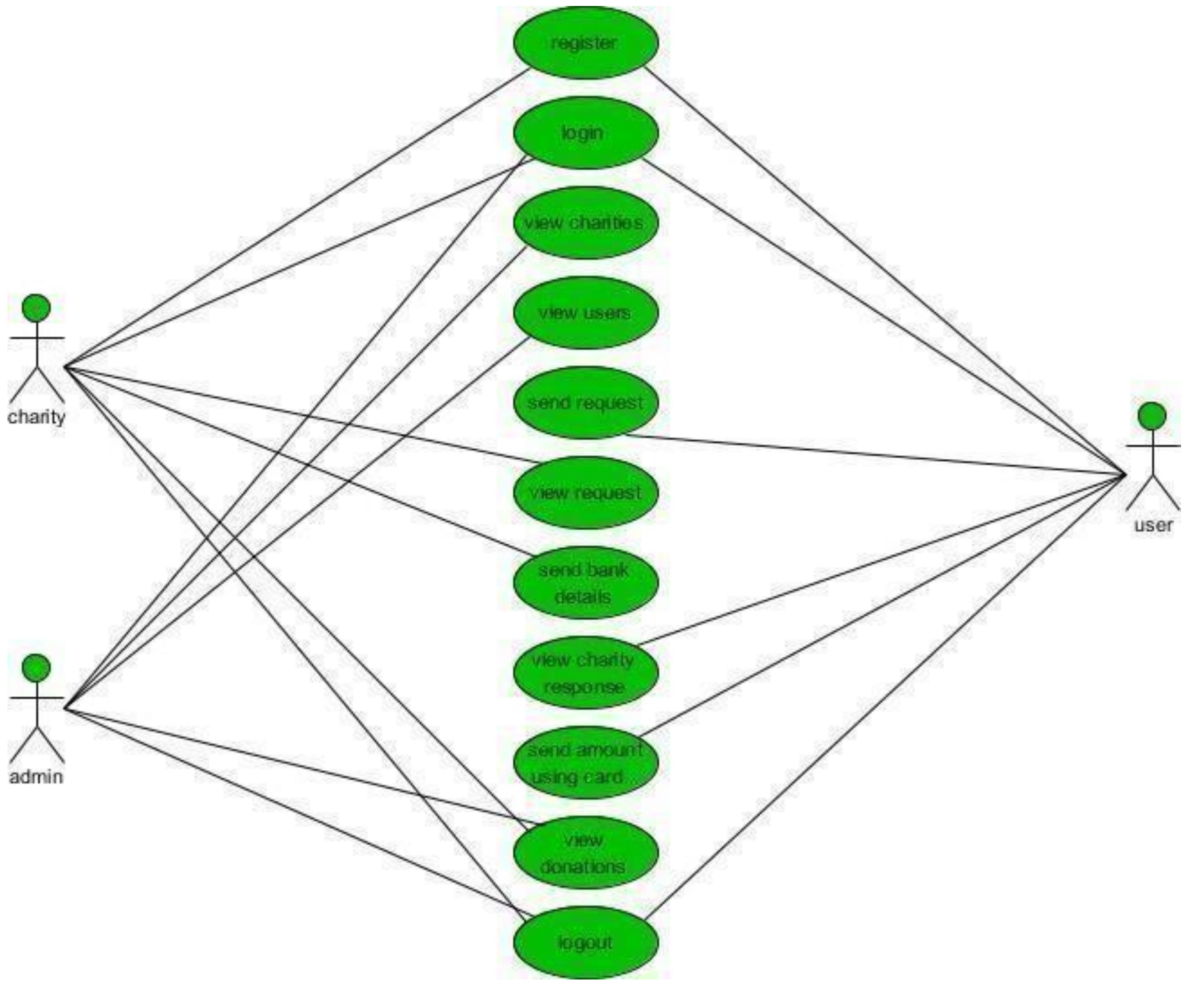


Fig. 4.2 Use case Diagram

4.3.2 Class Diagram

In this project, a class diagram is a graphic representation that uses the Unified Modelling Language (UML) to show the relationships and structure of a system's classes. Each class in the diagram represents a blueprint for creating objects, encapsulating data and behavior. The diagram shows the attributes (or characteristics) of each class, such as variables or properties, along with the operations (or methods) that define how objects of that class behave.

The classes are connected through various relationships, illustrating how they interact and collaborate within the system. These relationships include associations, indicating connections between classes, and may be one-to-one, one-to-many, or many-to-many. Additionally, inheritance relationships depict how classes inherit attributes and behavior from parent classes, enabling code reuse and hierarchical organization. Interfaces, represented by dashed lines, define a contract specifying the methods that a class must implement.

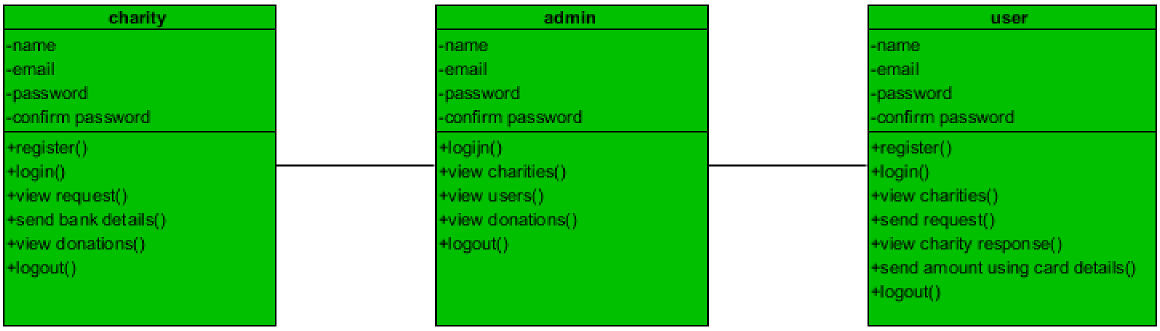


Fig. 4.3 Class Diagram

Overall, class diagrams provide a high-level overview of the system's structure, showing which classes exist, their properties and behaviors, and how they interact with each other. They serve as a blueprint for designing and implementing software systems, aiding in communication among stakeholders and guiding the development process.

4.3.3 Sequence Diagram

In this project, a sequence diagram is a visual representation utilizing the Unified Modeling Language (UML) to illustrate the chronological flow of interactions between various components or objects within a system. Each component or object is represented by a lifeline, showing its existence over time, and messages between them depict the sequence of actions or communications. These messages can indicate method calls, data exchanges, or other interactions, showcasing how the system processes information or performs tasks. The sequence diagram delineates the order in which these interactions occur, helping to visualize the dynamic behavior of the system during runtime. Alongside messages, the diagram may also feature fragments to represent conditional or iterative behavior, offering insights into different execution paths within the system. Combined, these elements provide a comprehensive depiction of how components collaborate and communicate to accomplish system functionality. Sequence diagrams serve as valuable tools for understanding system dynamics, identifying potential bottlenecks or inefficiencies, and aiding in system design and optimization efforts.

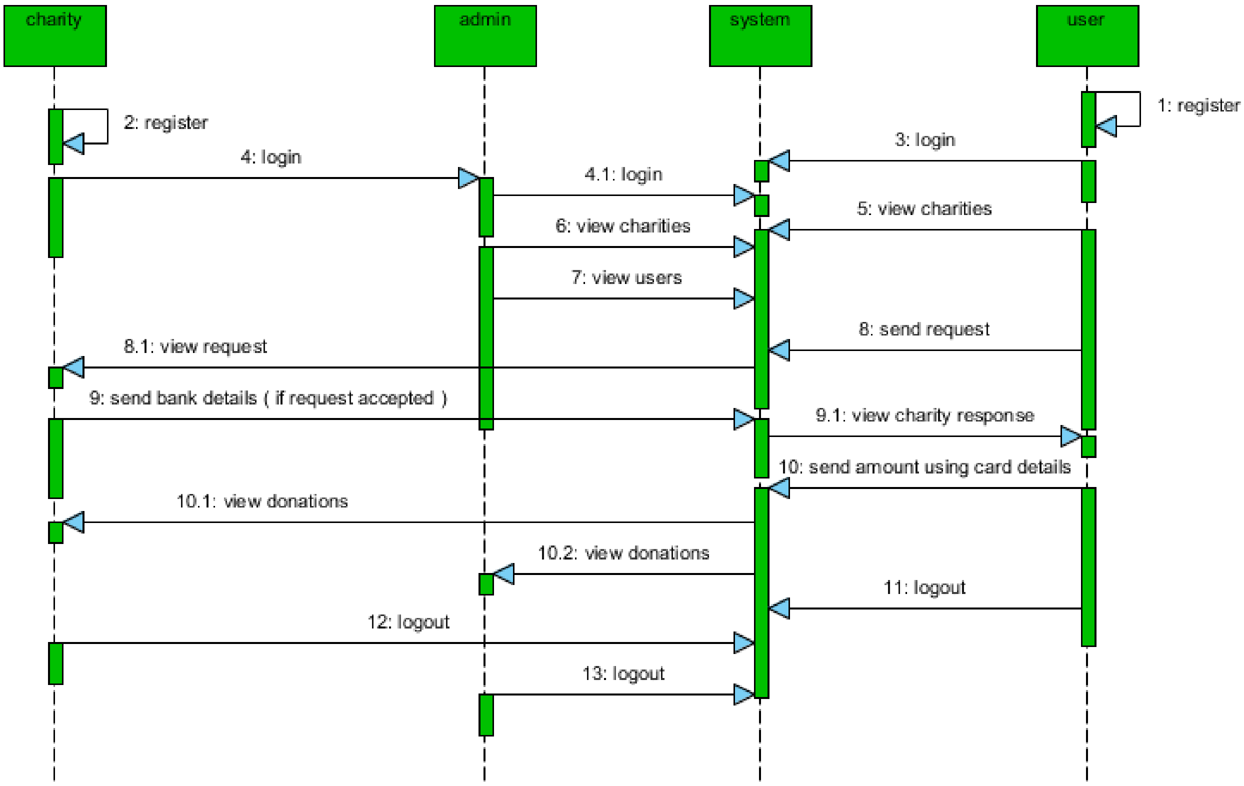


Fig. 4.3.3.1 Sequence Diagram

4.3.4 Activity Diagram

In this project, an activity diagram is a graphical depiction of system workflows or processes, usually made with the Unified Modelling Language (UML). It shows the flow of decisions, events, and activities that take place when a system or business process is being executed. At its core, an activity diagram consists of various elements, including actions, control flows, decisions, and forks/joins. Actions represent individual steps or tasks within the process, such as sending an email or processing data. Control flows depict the sequence in which actions are performed, showing the order of execution.

Decision points, represented by diamonds, indicate conditional branching based on certain criteria, allowing the process to take different paths depending on specific conditions. Forks and joins are used to split and merge control flows, enabling parallel execution of activities and synchronization of multiple paths.

Activity diagrams are particularly useful for modeling complex processes, as they provide a clear visualization of the flow of activities and decision logic. They help stakeholders understand how a system behaves under different scenarios, facilitating communication and analysis of process requirements. Moreover, activity diagrams can be used throughout the software development lifecycle, from requirement analysis and design to implementation and testing. They serve as a blueprint for developers to understand the system's behavior and for testers to identify test cases and scenarios.

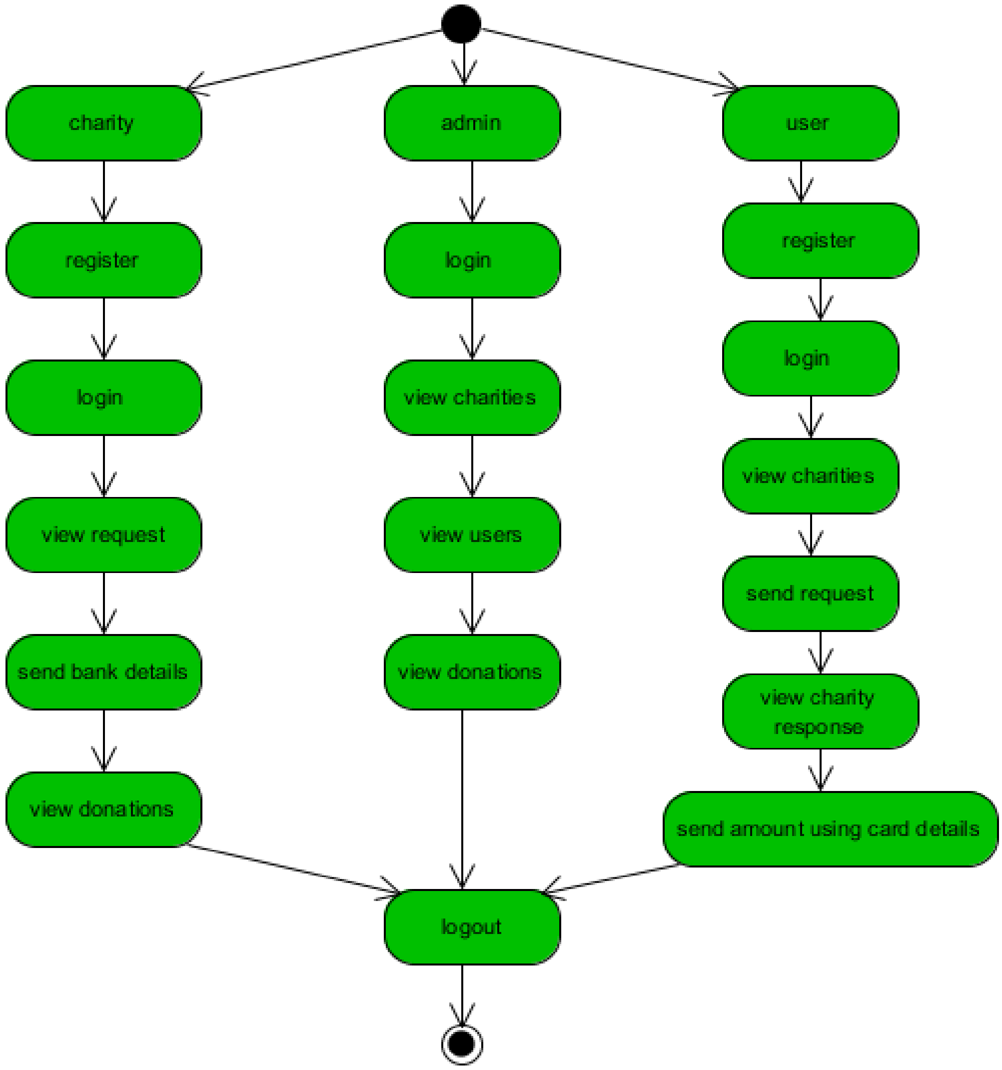


Fig. 4.3.4.1 Activity Diagram

Overall, activity diagrams are powerful tools for modeling and analyzing workflows, enabling stakeholders to gain insights into system behavior and aiding in the development and maintenance of software systems.

4.4 Data Flow Diagram

To visualise the information flows inside a system, a data flow diagram (DFD) is a frequently used tool. An extensive portion of the system requirements may be graphically represented by a clean, simple DFD.

The execution can be done manually, automatically, or concurrently. Information storage locations, data entry and exit points, and modifications made to the data are all displayed. The limits and general scope of a system are displayed using a DFD. In order to communicate with a systems analyst, which is the first step in system redesign, it may be utilised by any system users.

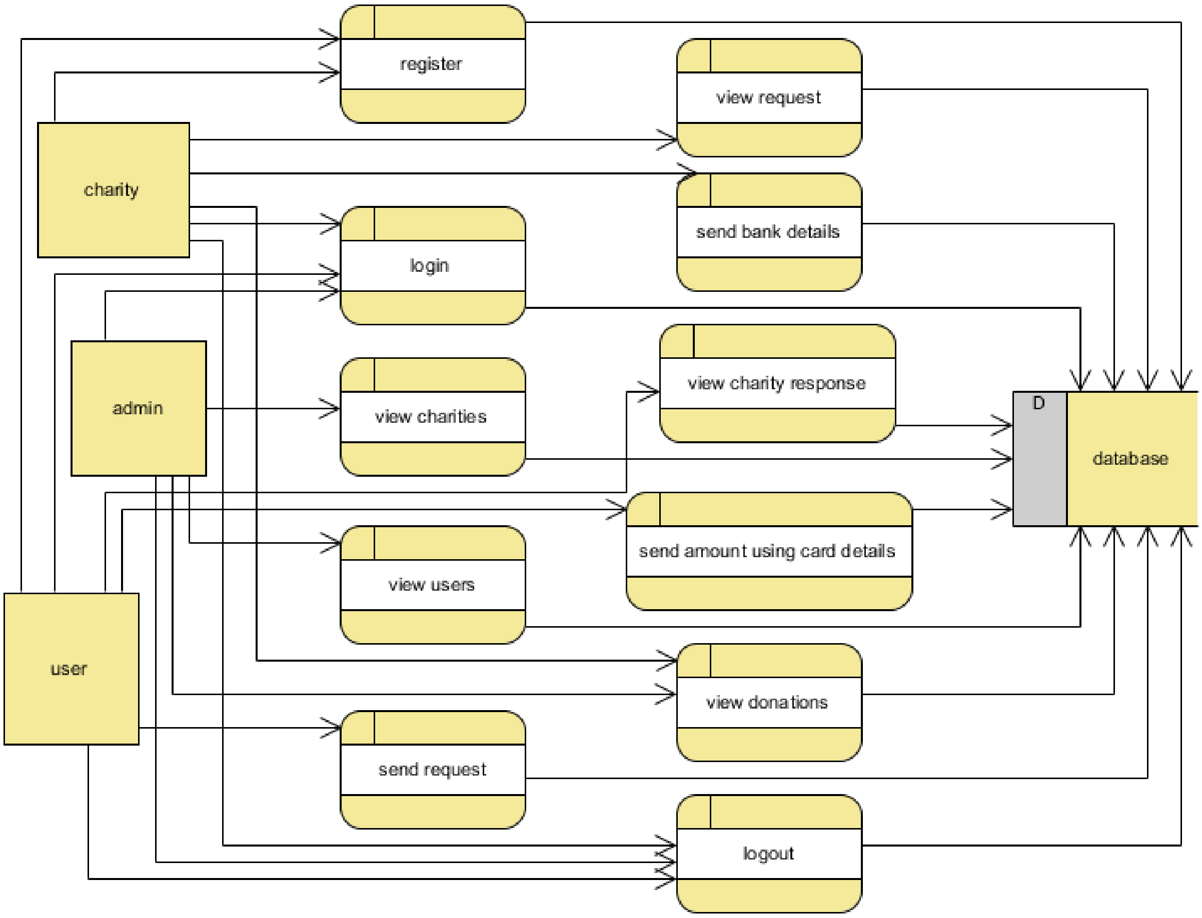


Fig. 4.4.1 Data Flow Diagram

CHAPTER - 5

IMPLEMENTATION & RESULTS

The implementation phase is a crucial step in turning the vision of a blockchain-based charity donation system into reality. Using Ethereum, smart contracts, and a hybrid PoA-PoS consensus model, this stage is dedicated to transforming theoretical concepts into a fully functional, transparent, and secure platform. The focus is on coding, seamless integration, and rigorous testing to ensure the system meets all predefined requirements and operates efficiently. At the core of this phase is the development of secure and automated smart contracts using Solidity, deployed on the Ethereum blockchain. These contracts facilitate decentralized transactions, ensuring that donations are processed fairly and transparently. The system also incorporates wallet connectivity, real-time transaction tracking, and authentication mechanisms, making it user-friendly and highly secure. Additionally, various components such as data encryption, consensus validation, and automated fund distribution are integrated to ensure smooth and efficient processing of donations. The hybrid consensus mechanism enhances security while maintaining scalability, ensuring that donor identities remain protected and charities receive funds directly without intermediaries In essence, this phase plays a key role in bringing the project to life, establishing a trustworthy, efficient, and scalable donation ecosystem. By leveraging the power of blockchain technology, the system aims to revolutionize charitable giving, promoting accountability, transparency, and efficiency in every transaction.

5.1 Parameter Settings

The blockchain-based charity donation system is designed to provide secure, transparent, and decentralized transactions using Ethereum, Solidity, and a hybrid PoA-PoS consensus model. The key parameters that shape the functionality of this system are as follows:

Blockchain Network Configuration:

- **Ethereum Network:** The donation system operates on the Ethereum blockchain, ensuring that all transactions are decentralized, immutable, and publicly verifiable.
- **Consensus Mechanism:** A hybrid Proof of Stake (PoS) and Proof of Authority (PoA) model is implemented, combining PoS's efficiency with PoA's security and speed, making transactions both reliable and scalable.

Smart Contract Parameters:

- **Contract Deployment Address:** Each smart contract has a unique deployment address on the Ethereum network, serving as its identifier and ensuring donors interact with the correct contract.
- **Gas Fee (Transaction Cost):** Every transaction on the blockchain requires gas fees, determined by the gas limit and gas price, ensuring efficient resource utilization.

- **Donation Function:** The smart contract includes predefined logic to securely transfer donations from users to verified charities, eliminating the need for intermediaries and ensuring trustless transactions.

Security & Encryption:

- **Data Protection**: Sensitive donor details and transaction history are encrypted to prevent unauthorized access.

- **Access Control:** Role-based access ensures that only authorized entities can modify key parameters, preventing fraudulent activities.

Direct Smart Contract Interaction:

- **No Third-Party Wallets:** Donations are processed directly through smart contracts without relying on external wallet providers.

- **Direct Ethereum Transactions:** Users interact with the contract using Ethereum's built-in transaction system, eliminating intermediaries.

5.2 Method of Implementation

The charity donation system built on blockchain technology ensures secure, transparent, and decentralized transactions using Ethereum smart contracts. By eliminating intermediaries, it allows donors to contribute directly to verified charities while maintaining complete transparency and accountability.

The process begins with deploying Solidity-based smart contracts on the Ethereum blockchain. These contracts establish clear rules for donations, ensuring that funds are securely transferred and permanently recorded on the blockchain. Unlike conventional systems that rely on third-party wallets, this platform enables direct interaction with smart contracts, allowing users to initiate transactions without external wallet dependencies.

When a donor makes a contribution, they specify the amount and recipient address, and the smart contract processes the transaction accordingly. A hybrid PoA-PoS consensus mechanism is used to validate transactions, enhancing security and preventing fraudulent activities. Once verified, the smart contract automatically transfers the donation to the intended recipient and immutably logs the transaction on the blockchain

To protect donor privacy, all transaction data is encrypted, ensuring secure storage and access. Additionally, role-based access control mechanisms within the smart contract prevent unauthorized modifications, allowing only verified entities to manage key parameters. Donors can track their contributions in real time using blockchain explorers, fostering trust and confidence in the system.

By leveraging Ethereum's decentralized infrastructure, this solution enhances the efficiency and reliability of charitable donations. Automating transactions through smart contracts not only eliminates middlemen but also ensures transparency, security, and greater donor confidence in the donation process.

Software Components:

- **Ethereum Blockchain & Solidity:** The system is built on the Ethereum blockchain, ensuring a decentralized and tamper-proof environment for handling donations. Smart contracts, written in Solidity, automate the entire process—eliminating intermediaries and enforcing secure, transparent transactions.
- **Hybrid Consensus Mechanism (PoA & PoS):** To balance efficiency and decentralization, the system integrates a hybrid Proof of Authority (PoA) and Proof of Stake (PoS) model. PoA allows trusted nodes to validate transactions quickly, while PoS enables stakeholders to contribute to the network's security and integrity.
- **Direct Smart Contract Interaction:** Unlike conventional platforms that rely on external wallets, this system enables users to interact directly with smart contracts. Donations can be processed through predefined contract functions, minimizing reliance on third-party wallet services and improving security.
- **Data Security & Encryption:** To protect donor privacy and transaction details, the system uses encryption techniques and secure access control mechanisms within the smart contracts. This ensures that only authorized entities can modify critical contract parameters, preventing unauthorized alterations.
- **Blockchain Explorer & Transaction Tracking:** Every transaction is permanently recorded on the Ethereum blockchain, allowing real-time tracking through blockchain explorers. This feature ensures full transparency, enabling donors and charities to verify donations and monitor fund distribution with ease.

5.3 Source Code

Smart Contract Code

```
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.20;
contract CharityDonation {
    address public owner;
    struct Donation {
        address donor;
        uint256 amount;
        uint256 timestamp;}
    mapping(address => Donation[]) public donations;
    event DonationReceived(address indexed donor, uint256 amount, uint256 timestamp);
constructor() { owner = msg.sender; }
  function donate() public payable {
        require(msg.value > 0, "Donation must be greater than zero");
        donations[msg.sender].push(Donation(msg.sender, msg.value, block.timestamp));
        emit DonationReceived(msg.sender, msg.value, block.timestamp);
function getDonations(address _donor) public view returns (Donation[] memory) {
        return donations[_donor];}
    function withdrawFunds(address payable _recipient, uint256 _amount) public {
```

```
        require(msg.sender == owner, "Only owner can withdraw funds");
        require(address(this).balance >= _amount, "Insufficient funds");
_recipient.transfer(_amount);  }
    function getContractBalance() public view returns (uint256) {
        return address(this).balance; }}
```

Frontend Source Code

```
import React, { useState } from 'react';
import Web3 from 'web3';
import DonationContract from './contracts/CharityDonation.json';
function App() {
    const [account, setAccount] = useState('');
    const [amount, setAmount] = useState('');
    const loadBlockchainData = async () => {
        if (window.ethereum) {
            const web3 = new Web3(window.ethereum);
            await window.ethereum.request({ method: 'eth_requestAccounts' });
            const accounts = await web3.eth.getAccounts();
            setAccount(accounts[0]);
            const networkId = await web3.eth.net.getId();
            const contractAddress = DonationContract.networks[networkId].address;
            const donationContract = new web3.eth.Contract(DonationContract.abi, contractAddress);
            return { web3, donationContract }; }};
    const donate = async () => {
        const { web3, donationContract } = await loadBlockchainData();
        await donationContract.methods.donate().send({ from: account, value:
```

```
 web3.utils.toWei(amount, 'ether') });

    alert("Donation successful!");};

  return (

    <div>

      <h1>Charity Donation System</h1>

      <p>Connected Wallet: {account}</p>

      <input type="text" placeholder="Enter amount in ETH" onChange={(e) => setAmount(e.target.value)} />

      <button onClick={donate}>Donate</button>

    </div>);}
```

Backend Code:

```
const express = require('express');

const Web3 = require('web3');

const contractABI = require('./CharityDonationABI.json'); // Store ABI separately

const contractAddress = "0xYourContractAddress"; // Replace with deployed contract address

const app = express();

const web3 = new Web3(new Web3.providers.HttpProvider('https://sepolia.infura.io/v3/YOUR_INFURA_PROJECT_ID'));

const donationContract = new web3.eth.Contract(contractABI, contractAddress);

app.use(express.json());

// Fetch contract balance

app.get('/balance', async (req, res) => {

  const balance = await donationContract.methods.getContractBalance().call();

  res.json({ balance: web3.utils.fromWei(balance, 'ether') + " ETH" });

});

// Fetch donations of a user

app.get('/donations/:address', async (req, res) => {

  const donations = await donationContract.methods.getDonations(req.params.address).call();
```

```
    res.json(donations);
});
// Withdraw funds (Admin only)
app.post('/withdraw', async (req, res) => {
    const { recipient, amount, privateKey } = req.body;
    const tx = donationContract.methods.withdrawFunds(recipient, web3.utils.toWei(amount, 'ether'));
    const signedTx = await web3.eth.accounts.signTransaction({ to: contractAddress, data: tx.encodeABI(), gas: 2000000 }, privateKey);
    const receipt = await web3.eth.sendSignedTransaction(signedTx.rawTransaction);
    res.json({ message: "Funds withdrawn", receipt });
});
app.listen(3000, () => console.log('Server running on port 3000'));
```

5.4 Output Screenshots

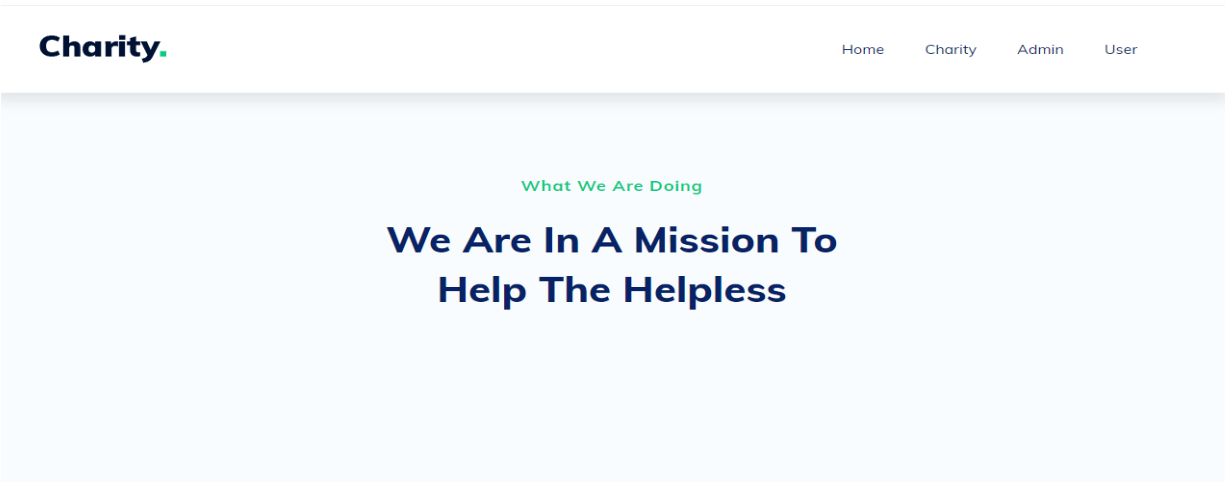


Fig. 5.4.2 Charity Home Page

It shows the homepage with the branding "Charity." and a simple message: *"We Are In A Mission To Help The Helpless"*. The navigation bar at the top includes links for Home, Charity, Admin, and User sections, indicating different access points depending on the user's role.

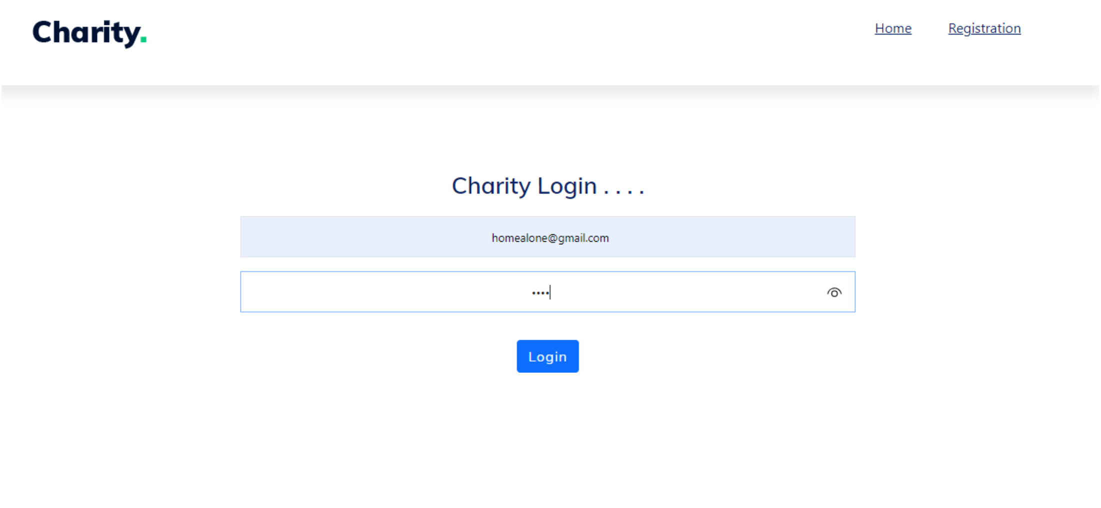


Fig. 5.4.3 Charity login page

It is a login form for existing charity users. It asks for an email and a password, providing a secure way for registered users to access their accounts. There's a small "eye" icon to toggle password visibility, and navigation links for "Home" and "Registration" at the top.

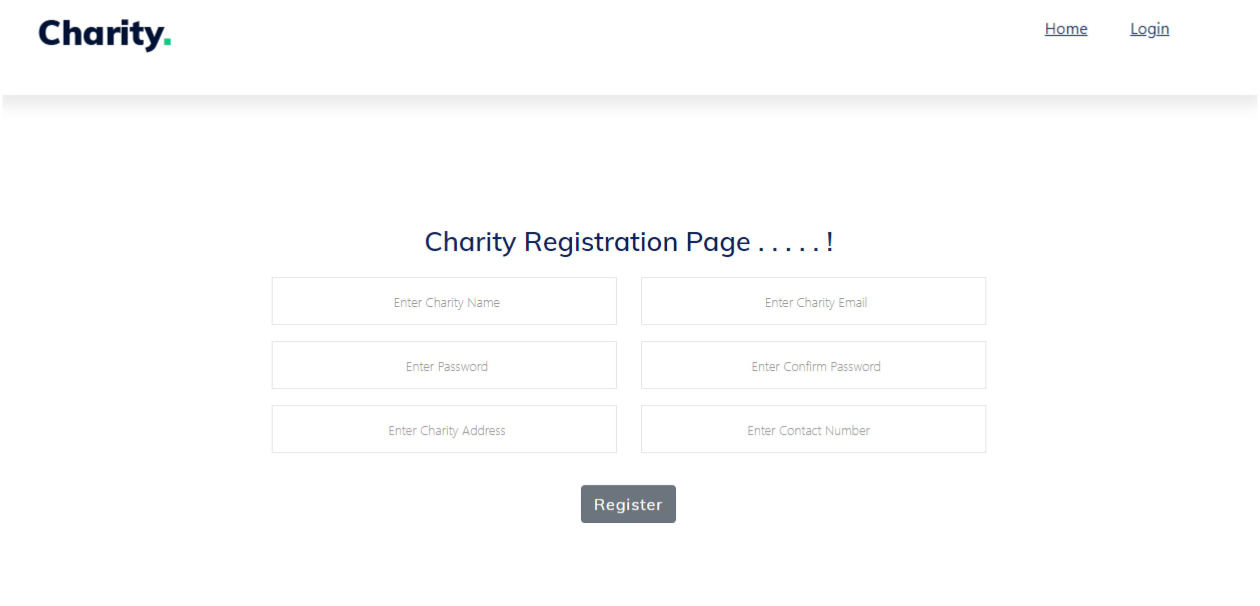


Fig. 5.4.4 Charity Registration page

This is the registration page for new charities. It has fields for charity name, email, password (and confirm password), address, and contact number. A "Register" button at the bottom allows new charities to create an account. Like the login page, it also offers easy navigation to "Home" and "Login".

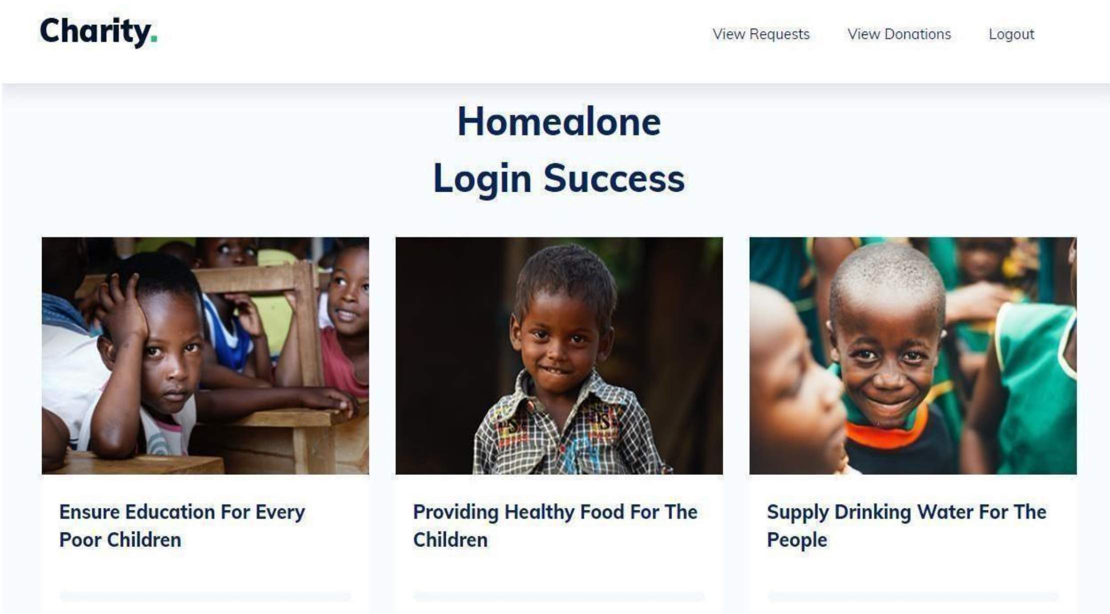


Fig. 5.4.5 Charity Home page

It shows the Login Success Dashboard of the Charity Management System. After logging in successfully, the charity user "Home alone" is greeted with a success message. Below the message, three charity initiatives are displayed with images: ensuring education for every poor child, providing healthy food for children, and supplying drinking water for people. Each section highlights a different cause, making it easier for users to understand the organization's focus areas and engage with their missions.

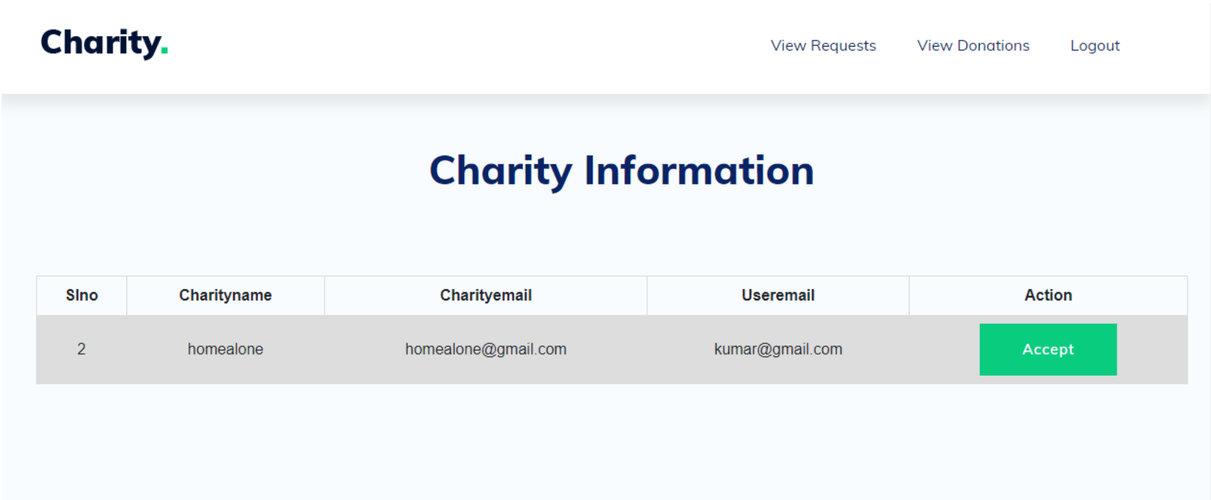


Fig. 5.4.6 Charity information

This page shows a table listing important information such as the charity name, charity email, user email, and an action button. In this case, the charity "Homealone" has a pending request from a user (kumar@gmail.com) that can be accepted by clicking the green "Accept" button. This functionality enables charities to manage user interactions, such as volunteer requests or support offers.

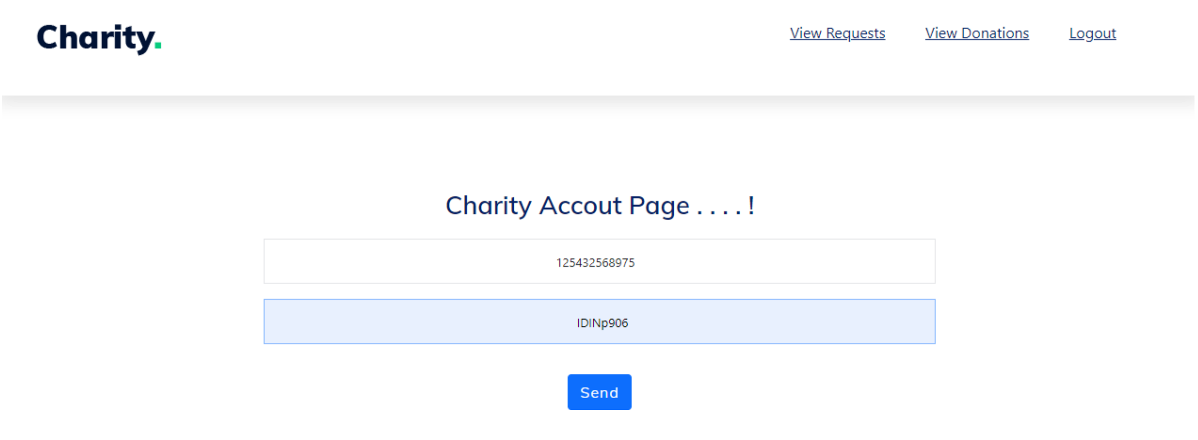


Fig. 5.4.7 Charity Account Page

Here, the charity is asked to provide account details, likely for donation or fund management purposes. The page includes two fields: one for an account number and another for an ID, with a "Send" button to submit the details. This section ensures that the charity can securely manage financial transactions within the system.

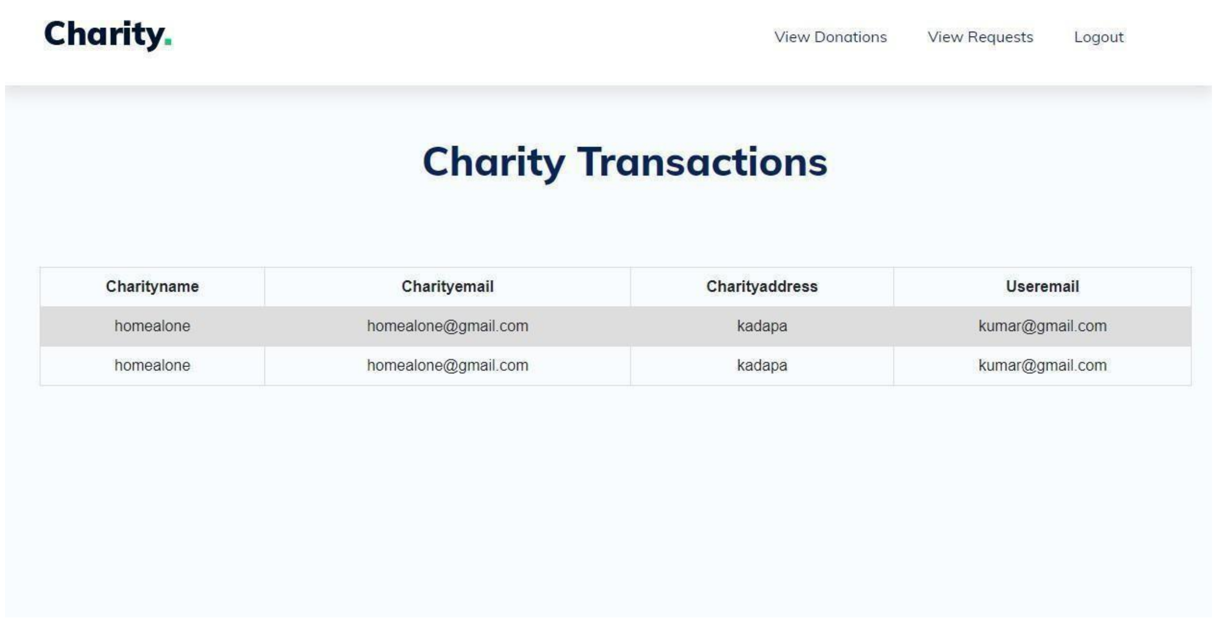


Fig. 5.4.7 Charity Transaction page

The Charity Transactions Page. This section provides a table summarizing the transaction records between charities and users. It lists the charity name, charity email, charity address, and the user email involved in the transaction. In the example shown, the charity "Homealone" based in "Kadapa" has transactions linked with the user "kumar@gmail.com." This table helps track all interactions and supports better transparency between donors, charities, and users.

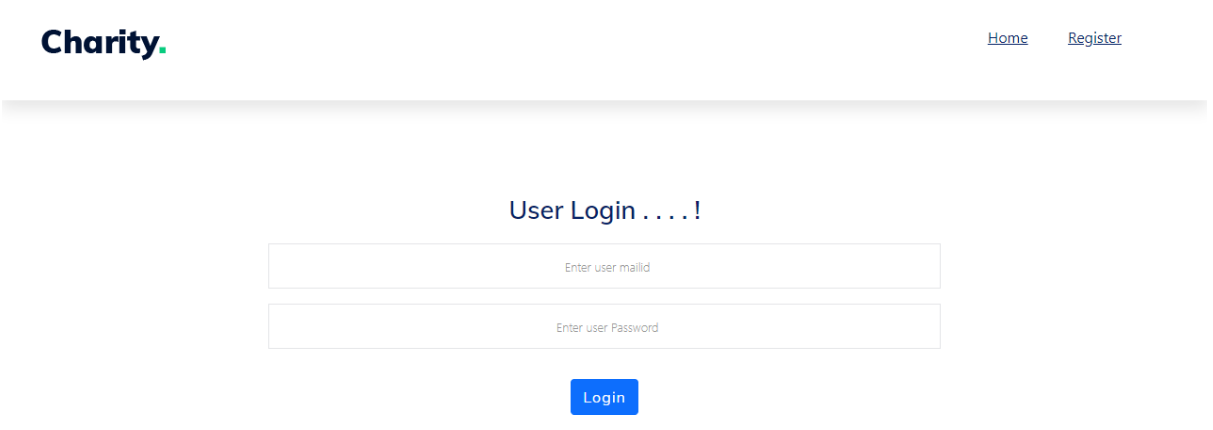


Fig. 5.4.8 User Login Page

The User Login Page of the Charity Management System. This page allows users to access their accounts by entering their registered email ID and password. It is designed with a clean and minimal interface to ensure users can easily log in without confusion. Options for navigating to the "Home" page or registering a new account are also available at the top for easy access.

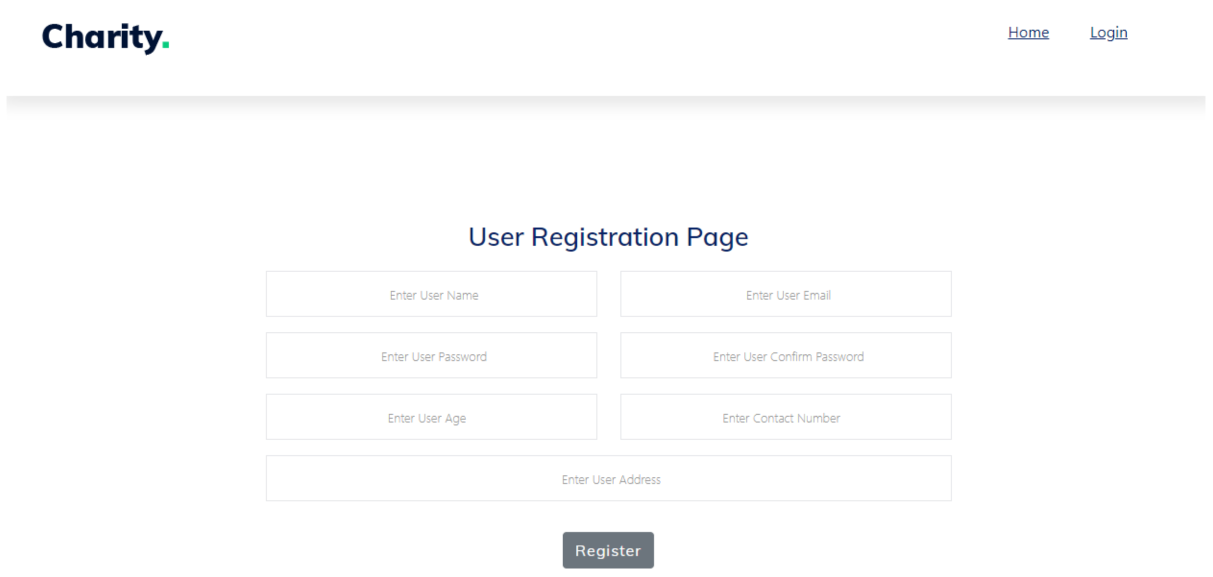


Fig. 5.4.9 User Registration page

The User Registration Page. New users can sign up here by providing necessary details such as their name, email, password, age, contact number, and address. The form is organized into multiple fields, ensuring all important information is collected before account creation. The "Register" button at the bottom finalizes the registration process, allowing users to become part of the charity platform and start interacting with various services.

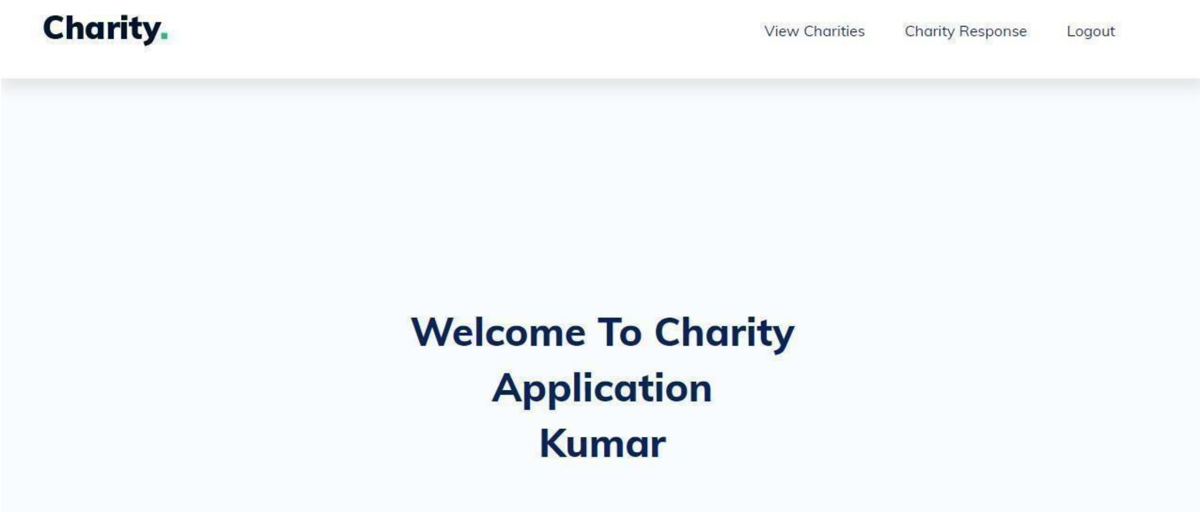
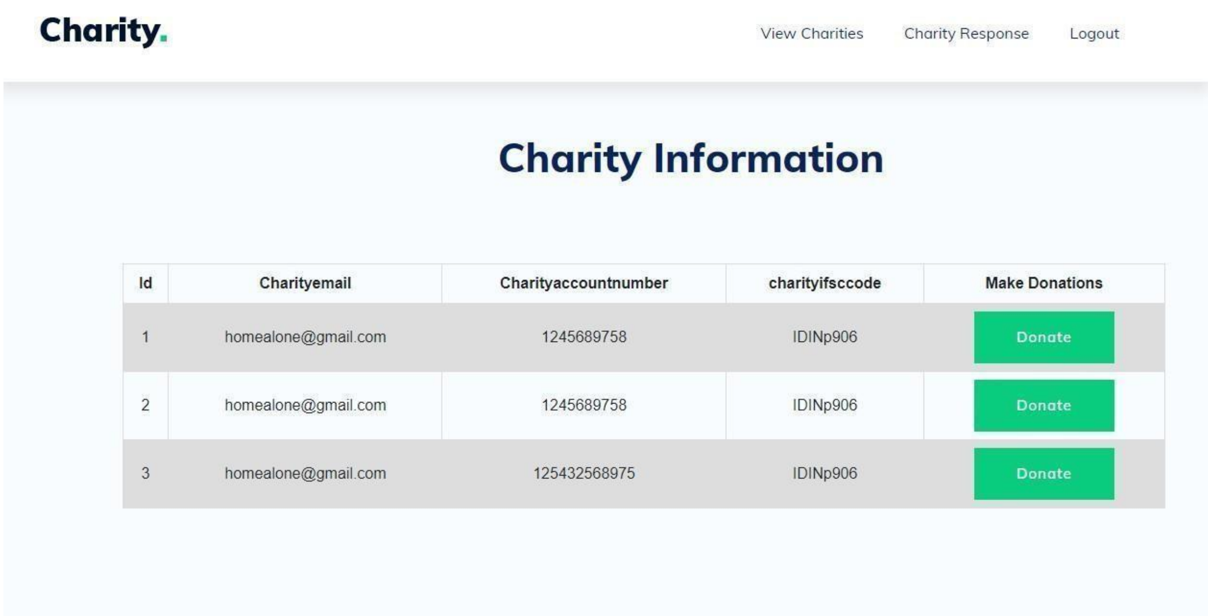


Fig. 5.5.1User Home page

It greets the user, specifically addressing them by their name, creating a personalized touch. The layout is clean with minimal distractions, featuring a navigation bar at the top that includes links to view charities, check charity responses, and log out of the application. The focus of this page is clearly on making the user feel acknowledged and ready to explore the platform.



Id	Charityemail	Charityaccountnumber	charityifsccode	Make Donations
1	homealone@gmail.com	1245689758	IDINp906	Donate
2	homealone@gmail.com	1245689758	IDINp906	Donate
3	homealone@gmail.com	125432568975	IDINp906	Donate

Fig. 5.5.2 User Donation page

It organizes data in a tabular format, listing each charity's email, account number, and IFSC code. Next to each charity entry, there is a green "Donate" button that allows users to proceed with donations easily. The table is straightforward, aiming to provide all necessary information at a glance while maintaining a clean and professional appearance.

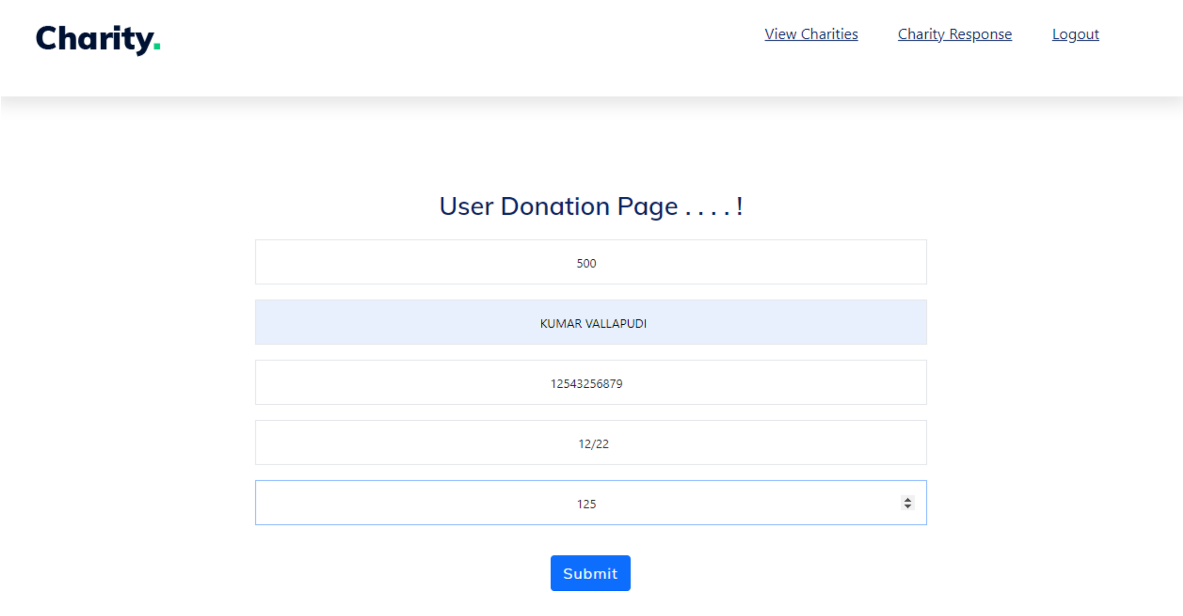


Fig. 5.5.3 User Donating money page

The "User Donation Page," where users can submit their donation details. It includes fields for entering the donation amount, user name, account number, card expiry date, and a selectable donation ID. After filling out the information, users can click the blue "Submit" button to complete their donation.

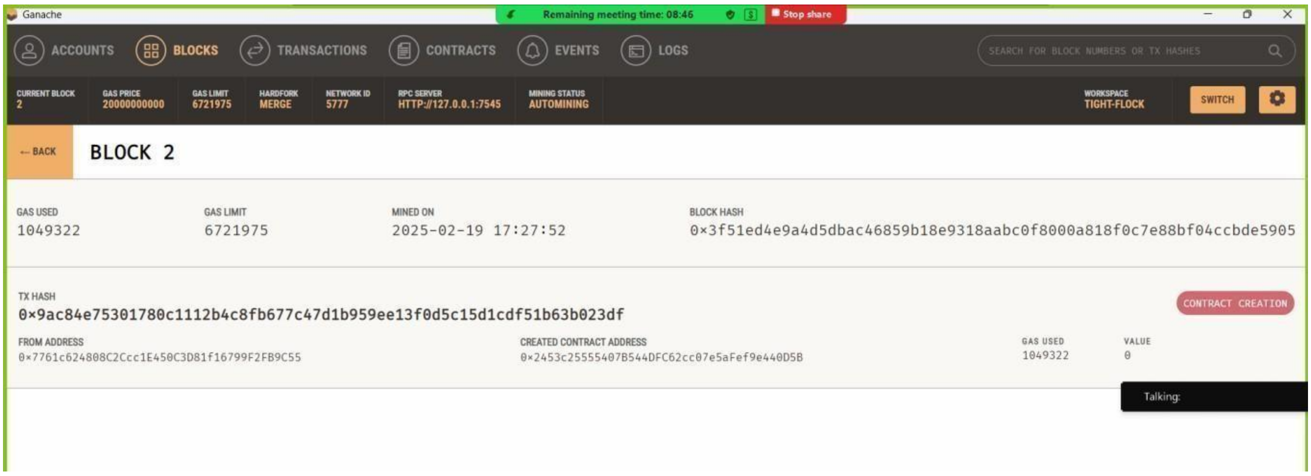


Fig. 5.5.4 Block chain Time Stamp

It shows the "Blocks" section of the Ganache blockchain simulation tool, specifically displaying the details for Block 2. Key block metrics are outlined at the top, including the gas used, the gas limit (6,721,975 units), and the mining timestamp (February 19, 2025, at 17:27:52). The block hash is also provided, uniquely identifying this block within the blockchain. Below that, transaction details are shown, highlighting the transaction hash, sender address, and the created contract address.

5.5 Result Analysis

The charity donation project using a hybrid PoA/PoS model on Ethereum successfully combines fast transaction speeds, low costs, and strong security. By using Proof of Authority (PoA) for quick validation and Proof of Stake (PoS) for added security, the system ensures transparent and efficient donations. Smart contracts automate donation processes, reducing the need for intermediaries and ensuring trust. While challenges like validator centralization and fluctuating gas fees exist, the hybrid model still provides a scalable and cost-effective solution for charitable donations, with room for future improvements like decentralized validators and Layer 2 solutions.

Gas Fee Calculation

Step 1: Extract Relevant Values

- **Gas Used**: 1,049,322
- **Gas Price**: 20 Gwei

Step 2: Calculate Gas Fee in Gwei

Gas Fee (Gwei)=Gas Used×Gas Price

Fee (Gwei)=1,049,322×20=20,986,440Gwei

Step 3: Convert Gas Fee to ETH

Gas Fee (ETH)=Gas Fee (Gwei)/10^9

Gas Fee (ETH)=20,986,440/1^9=0.02098644 ETH

- Gas Fee = 0.02098644 ETH our gas fees is below 0.03 So its efficient transaction fees

Transaction Type	**Gas Price (Gwei)**	**Gas Fee (ETH)**
Low Transaction Fees	1 - 10 Gwei	Very Low (Up to 0.001 ETH)
Efficient Transaction Fees	10 - 20 Gwei	Moderate (0.001 - 0.03 ETH)
High Transaction Fees	30+ Gwei	High (Above 0.03 ETH)

CHAPTER - 6

SYSTEM TESTING

Thorough testing is essential to guarantee the security, efficiency, and reliability of our blockchain-based charity donation platform. By carefully assessing each component, we can ensure a seamless, transparent, and user-friendly experience, making it ready for real-world use.

6.1 Testing Methodology

- **Test Case 1: Smart Contract Validation & Security**
  - **Objective:** Ensure that smart contracts execute correctly and securely without vulnerabilities.
  - **Test Scenario**: Deploy the smart contract on a test network and simulate real-world transactions such as donations, fund releases, and withdrawals. Validate that conditions are met before funds are transferred and prevent unauthorized actions.
  - **Unit Testing:** Use tools like Hardhat or Truffle to test individual smart contract functions, ensuring they execute properly and handle errors effectively.
  - **Security Testing:** Conduct audits to detect vulnerabilities, including reentrancy attacks, access control loopholes, and integer overflows. Use tools like Myth or Slither for automated security checks.
- **Test Case 2: Transaction Integrity & Blockchain Consensus**
  - **Objective:** Ensure transactions are immutably recorded and securely validated using blockchain consensus.
  - **Test Scenario:** Execute multiple transactions and verify that they are correctly recorded on the Ethereum blockchain with accurate timestamps. Test how the hybrid Proof of Stake (PoS) and Proof of Authority (PoA) consensus mechanism validates transactions.
  - **Integration Testing:** Confirm seamless interaction between smart contracts and the blockchain network, ensuring smooth execution and consensus agreement.
- **Test Case 3: Donor & Beneficiary Experience**
  - **Objective:** Validate that donors can easily contribute, and beneficiaries receive funds securely.
  - **Test Scenario:** Simulate a donor making a donation and ensure funds are allocated to the intended recipient. Verify that beneficiaries can only withdraw funds when the predefined conditions are met.
  - **Usability Testing:** Collect feedback from users (donors and recipients) to assess ease

of use, transaction clarity, and trustworthiness of the system's interface.

- **Test Case 4: Security & Fraud Prevention**
  - **Objective:** Protect against fraudulent transactions and unauthorized access attempts.
  - **Test Scenario**: Implement AI-driven anomaly detection to identify unusual donation patterns. Simulate attacks like double spending and unauthorized access attempts to evaluate the system's security resilience.
  - **Vulnerability Testing:** Conduct penetration tests to detect and mitigate potential security threats. Ensure data storage is encrypted and tamper-proof.
- **Test Case 5: Performance and Reliability**
  - **Objective:** Assess the system's efficiency, reliability, and stability under various conditions and workloads.
  - **Test Scenario:** Conduct stress testing by simulating multiple users performing transactions simultaneously. Monitor system response time, blockchain node performance, gas fee variations, and resource utilization (CPU, memory). Evaluate the impact of network congestion on transaction speed and cost.
  - **Performance Testing:** Measure system response time, transaction throughput, and resource consumption under different workloads. Assess how smart contract execution affects network performance, including latency and gas fees.
  - **Scalability Testing:** Simulate high transaction volumes with thousands of concurrent users. Test the effectiveness of Layer 2 scaling solutions (e.g., Optimistic Rollups, zk-Rollups) in improving transaction speed and reducing costs.
  - **Usability Testing:** Involve donors, beneficiaries, and administrators in usability testing. Assess ease of wallet integration, transaction execution, and fund withdrawal. Collect feedback on UI/UX, donation transparency, and user experience improvements.
  - **Security Testing:** Evaluate the system's security mechanisms, including data encryption, authentication, and access control. Perform vulnerability testing to detect risks like reentrancy attacks, front-running, and unauthorized access. Conduct penetration testing to identify and mitigate potential security threats..

CHAPTER - 7

CONCLUSION

7.1 Conclusion

In The blockchain-powered charity donation system transforms the way charitable contributions are managed by enhancing transparency, security, and efficiency. By integrating Ethereum, smart contracts, and a hybrid Proof of Authority (PoA) and Proof of Stake (PoS) protocol, the system ensures that donations are secure, traceable, and directly reach beneficiaries without intermediaries, reducing administrative costs and building donor confidence.One of the biggest challenges in traditional charity models is the lack of visibility into how donations are utilized. This system solves that issue by enabling real- time tracking, allowing donors to verify every transaction on the blockchain. Additionally, smart contracts automate fund distribution, ensuring that donations are released only when predefined conditions are met, minimizing the risk of fraud or misuse.By leveraging decentralization and immutable records, this system ensures secure, cost-effective, and globally accessible donations. It removes reliance on financial intermediaries, lowers transaction fees, and guarantees that funds serve their intended purpose. Ultimately, this project establishes a reliable and transparent donation ecosystem, empowering donors and maximizing the impact of charitable giving.

Future Scope

- Advanced Fraud Detection & Secure Transactions: AI strengthens the security of charitable donations by monitoring transactions in real time. It identifies suspicious activities, unusual patterns, and potential fraud, preventing misuse of funds. By analyzing past donation trends, AI proactively detects risks, ensuring a transparent and trustworthy donation process.
- Smarter Impact Analysis & Personalized Donor Experience: AI provides real-time insights into how donations are utilized, allowing donors to track the impact of their contributions. Instead of donating without visibility, they receive meaningful updates on how their support benefits beneficiaries. Additionally, AI personalizes the giving experience by suggesting causes that align with a donor’s interests and past contributions, fostering deeper engagement and long-term philanthropic involvement.

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PAPER PUBLICATION

Conference Acceptance Letter

3rd International Conference on Inventive Computing and Informatics
ICICI 2025
4-6, June 2025 - https://icinci.com/2025/ - iciciconfcontact@gmail.com

Acceptance Letter

Paper Title: A Review on Enhancing Donor Engagement through Blockchain-Based Charity Systems

Acceptance id: ICICI-001

Authors: Praveena N, Y. Mohan Kumar, P. Purushottam, A.Pradeep Kumar Reddy, N. Prasanth Reddy

Dear Authors,

On behalf of the Conference committee, we would like to congratulate you on your article to the **ICICI 2025** IEEE Conference, which will be held from **4-6, June 2025** at **S.E.A College of Engineering and Technology**, Bangalore, Karnataka, India. You have been selected to deliver your presentation at the 3rd International Conference on Inventive Computing and Informatics ICICI 2025.

As a result of the review and results, we are pleased inform that you can now submit the camera-ready paper for inclusion into the ICICI proceedings. We appreciate if you could send the final version of your research paper at your earliest convenience, in order to ensure the timely publication. When submitting your final paper, please highlight the changes made according to the review comments.

Yours sincerely,

Dr. Usha Desai,
Organizing Secretary
ICICI 2025

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A Review on Enhancing Donor Engagement through Blockchain-Based Charity Systems

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***Abstract*— Blockchain technology holds significant promise for transforming the charity donation ecosystem by enhancing transparency, trust, and operational efficiency. Through the use of decentralized, immutable ledgers, blockchain ensures that every transaction is securely recorded and traceable, reducing the risk of fraud and misuse of funds. By introducing smart contracts, donations can be automatically allocated to intended beneficiaries based on predefined conditions, eliminating the need for intermediaries and minimizing administrative costs. This real-time traceability not only boosts donor confidence but also ensures that charitable organizations are held accountable for the funds they receive. Moreover, blockchain enables global participation, allowing individuals from any part of the world to contribute securely and transparently. This paper explores the practical implementation of blockchain for charity donations using the Ethereum network and highlights its potential to bring lasting improvements to the sector. As this technology continues to evolve, it is poised to become a cornerstone in the future of charitable donations.**

***Index Terms*— Blockchain, Ethereum, Smart Contracts, Hybrid Consensus, Transparency, Accountability, Charity Systems, Validator Reputation**

I. Introduction

During emergencies, donations are crucial for supporting relief efforts, but traditional charity systems in India often struggle with a lack of transparency, accountability, and trust. Donors are frequently unsure whether their contributions reach the right hands, and concerns about fund misuse discourage genuine support. In addition, poor access to centralized data and low awareness of available resources can delay or disrupt aid distribution. Donations made through the platform are recorded on an immutable ledger, allowing donors to track their contributions in real-time. A reputation-based validator system further enhances reliability by reducing the risk of fraud or manipulation. By making donation records transparent and tamper-proof, this solution builds confidence among donors and ensures that aid reaches the people who need it most

1 **Transparent Donation Tracking:** Blockchain offers a secure and transparent way to track charity donations. Every transaction is recorded, ensuring funds are used as intended and improving accountability.

2 **Immutable Records:** Once recorded, blockchain transactions cannot be changed or deleted, ensuring accurate, trustworthy charity records and reducing the risk of fraud or corruption.

3 **Decentralization:** Blockchain utilizes a decentralized approach to data storage, ensuring that no single entity has complete control. by leveraging a distributed ledger, every participant in the network maintains a copy of the data, making unauthorized alterations more challenging and significantly reducing the risk of Manipulation.

4 **Secure and Fast Transactions:** Using a hybrid consensus protocol, blockchain ensures both security and faster transaction processing, enhancing the overall efficiency and reliability of the donation system.

II. Blockchain Technology

Before Blockchain is an innovative technology that improves transparency, accountability, and transaction efficiency. It serves as a framework for secure interactions, reducing costs and streamlining processes by removing the need for third-party intermediaries. Blockchain functions as a decentralized system that securely logs verified transactions across multiple participating computers, eliminating the reliance on a central authority. Each transaction is securely stored in a block, which is then connected to preceding blocks, creating an immutable chain known as the blockchain. Blockchain technology is being implemented across diverse fields such as finance, healthcare, and telecommunications, providing secure and efficient solutions. In recent years, it has also gained traction in the charity sector, addressing critical challenges such as fraud, mismanagement of funds, and lack of transparency. By leveraging blockchain, charitable organizations can ensure that donations are traceable, funds are used efficiently, and trust is established among donors and beneficiaries. Blockchain this makes it especially useful in sectors like charitable donations, where maintaining trust through transparency is essential.

Blockchain platform, to create smart contracts that automatically execute donation transactions based on predefined rules, ensuring the funds are used as intended. A hybrid consensus approach that merges the credibility-based validation of Authority Consensus with the stake-driven security of Stake-Based Verification. enhances the network's security, scalability, and efficiency, while ensuring fast transaction validation. Donors can use MetaMask, a blockchain wallet, to make contributions directly to the smart contracts, providing a seamless and trustworthy donation experience. This system enables real-time tracking donations, offering transparency about how funds are being utilized, fostering trust among donors, and ensuring accountability for charitable organizations.

A. *RELEVANT TERMINOLOGIES*

1. **Blockchain**: Blockchain is a form of decentralized ledger technology (DLT) that spreads data across multiple computers in a network. Once recorded, transactions or data entries are securely time-stamped and cannot be altered, ensuring transparency and reliability. To keep the records consistent across all participants, blockchain relies on consensus mechanisms. This makes it especially useful in sectors like charitable donations, where maintaining trust through transparency is essential.
2. **Ethereum**: Ethereum is a publicly accessible blockchain platform built to support the creation and execution of decentralized applications (Dapps) and smart contracts. Operating on a distributed network, it enables users to engage in transactions directly, eliminating the need for middlemen. Its capability to handle complex processes efficiently makes it ideal for applications requiring a high degree of transparency, such as automated systems for tracking donations.
3. **Smart Contracts:** Smart contracts are self-executing digital agreements designed to trigger actions automatically once predefined conditions are met. These agreements have their terms embedded in code, enabling secure and transparent transactions without relying on intermediaries. This not only enhances automation but also reduces the risk of fraud or manipulation. In the context of charitable donations, smart contracts ensure that funds are disbursed only when certain criteria, such as achieving a fundraising goal, are fulfilled.
4. **Hybrid Consensus Protocol:** A Hybrid Consensus Protocol blends two validation methods: Authority-Based Verification and Stake-Based Validation. In the stake-based approach, validators secure the network and confirm transactions by holding a certain stake. Meanwhile, the authority-based model relies on trusted entities to validate transactions, enhancing efficiency and scalability.

By integrating both mechanisms, this hybrid approach ensures a balance between security and fast transaction processing within a blockchain network.

B. *Architecture Diagram*

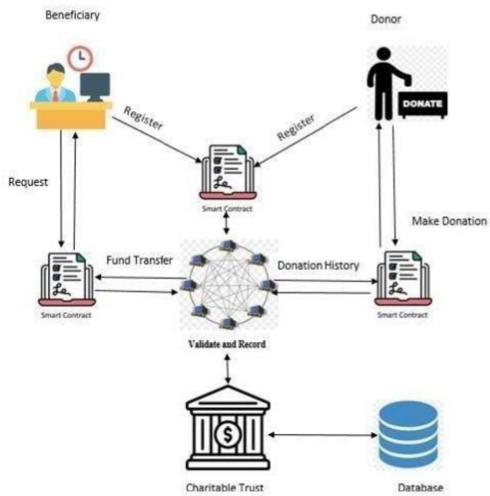

Fig. 1 Charity Donation Architecture Diagram.

Fig. 1 Shows the Architecture of Charity Donation System Using Blockchain Technology. The system architecture is built on the Ethereum blockchain to ensure transparent and secure donation management. Donors contribute through a MetaMask-integrated interface, with funds handled by smart contracts that release donations only when set conditions are met. A hybrid consensus mechanism, ensures both speed and decentralization. Trusted validators, selected based on stake and reputation, verify transactions, while an immutable ledger enables real-time tracking. This setup enhances trust, prevents misuse, and ensures efficient delivery of aid.

C. *Literature Review*

Blockchain technology has gained attention for its ability to improve trust and transparency in different areas, including charitable donations. Many earlier studies focused on the problems with traditional donation systems, such as lack of accountability, misuse of funds, and difficulty in tracking how donations are used. These studies helped to show how blockchain can be used to solve such issues by recording all transactions securely and making them visible to everyone involved. Later research built on these ideas by suggesting ways to use blockchain to directly connect donors with beneficiaries, remove middlemen, and use smart contracts to automatically handle fund transfers. Several researchers have explored how blockchain technology can be leveraged to enhance transparency and trust in charitable donations.

Kaur et al. [1] argue that a lack of transparency discourages donors and emphasize the moral responsibility tied to donations. They propose a blockchain-based mechanism on Ethereum, using smart contracts to record and trace all transactions. Similarly, Alam Syah and Amanda [2] highlight how donor confidence can be significantly improved using a traceability model that tracks every contribution, preventing fund misuse in the charity ecosystem. In line with this, Anupama et al. [3] developed a fund tracking system that runs on Ethereum and enables real- time transaction monitoring using smart contracts. Their prototype aims to combat corruption and improve accountability. Another system by Nadar et al. [4] focuses on enabling donors to monitor how their contributions are used, offering a user-centric approach through blockchain transparency. Further advancing this concept, Saranya et al. [5] introduced a blockchain-enabled crowdfunding platform that ensures each donation is securely processed and visible to all stakeholders. Dange et al. [6] presented a decentralized fundraising application that eliminates central authority, making the process more democratic and tamper-proof. Meanwhile, Barger et al. [7] and Gubaev et al. [8] both explored platforms built on Hyperledger Fabric to ensure immutability and donor confidence; their systems were designed to be scalable, transparent, and resistant to fraud or resource misallocation. In another notable study, Darshan et al. [9] created a smart contract-based ledger for managing fundraising efforts securely across distributed nodes, while Khalil et al. [10] provided a comprehensive look at blockchain's overall potential in charitable organizations, focusing on how transparency and accountability improve public trust. A practical implementation of this idea comes from Shaheen et al. [11], who used Hyperledger Composer to build a live donation tracking system with direct communication between donors and beneficiaries, eliminating the need for third parties. Singh et al. [12] delve into the cryptographic side of Ethereum, explaining how the Elliptic Curve Digital Signature Algorithm (ECDSA) is used to verify and sign transactions, ensuring authenticity and integrity.

Wu and Zhu [13] took a real-world scenario—the COVID-19 outbreak—and developed a blockchain service system to manage and distribute donations effectively, especially during health crises. Additionally, Sirisha et al. [14] proposed a trackable donation framework using a Byzantine consensus model on Ethereum, which not only provides security but also enhances scalability. Finally, Saleh et al. [15] presented an early yet impactful model for donation tracking that formed the foundation for many later systems, focusing on creating a reliable and tamper-resistant donation ledger for charitable foundations.

D. Literature Survey

S. No	Year &Journal	Title	Author	Description	Metrics	Advantages	Disadvantages
1	2024	"Blockchain Oriented Effective Charity Process During Pandemics and Emergencies"	"Mandeep Kaur, et al."	The paper proposes a blockchain based framework for crisis donations using Ethereum and smart contracts to ensure secure, traceable, transactions. It eliminates intermediaries, reduces costs, and mitigates fraud while providing real- time visibility of fund usage. Tests highlight its potential to enhance disaster recovery efforts.	Transparency ,security, Privacy, Traceability.	Transparency Traceability, Eliminates Intermediaries.	Proof of-Authority (PoA) Scalability Limitations, Energy Efficiency
2	2024	"Enhancing Donor Trust Through a Blockchain Based Traceability Model for Charitable Contributions"	"Andry Alamsyah et al."	A blockchain-powered traceability model is introduced to improve transparency and accountability in charitable donations, tackling concerns related to donor trust and fund mismanagement. This system ensures end-to-end tracking of donations from contributors to beneficiaries, engages key stakeholders, supports tax deduction processes, and aims to enhance trust with the future integration of a decentralized application (Dapp).	Transparency , immutability, traceability	Increased donor trust, Improved transparency and accountability	Implementation n complexity,
3	2023	"Fund Tracking System using Blockchain Technology"	"Anupama B et al".	This paper examines a blockchain powered fund tracking system built on Ethereum to enhance transparency and accountability in managing relief funds. By leveraging smart contracts, the system enables real- time transaction tracking, reduces the risk of corruption, and strengthens rust among stakeholders. Future plans include scaling the system and integrating it with public ledgers for broader adoption.	Transparency , Efficiency	High transparency, Secure data integrity	High energy consumption, High computational cost
4	2023	"A Platform for Tracking Charity Donations"	"Suraj Sahani et al."	This paper explores the development of a blockchain-powered platform for tracking charity donations, with the goal of enhancing transparency, accountability, and donor trust. It tackles key challenges faced by charitable organizations, such as fraud and fund mismanagement, which often erode donor confidence. By utilizing blockchain technology, the system securely records and verifies all donation transactions,	Transparency , Traceability	Improved transparency, Trust	Scalability Issues
5	2022	"Crowdfunding Charity Platform Using Blockchain"	"Dr. S. Saranya, et al."	This paper presents a blockchain based crowdfunding platform using Ethereum to ensure secure, transparent transactions for charitable donations and innovative projects. It integrates smart contracts, advanced analytics, and unique features like the auto pool circle program, offering a decentralized system that minimizes fraud, reduces fees, and provides tax benefits for donors while fostering community trust	Transparency , Security	Immutability, Decentralized structure	High Transaction Fees, Scalability and Efficiency

S. No	Year &Journal	Title	Author	Description	Metrics	Advantages	Disadvantages
6	2022	"Decentralized Fundraising Application Using Blockchain"	"Rishi Dange et al."	This paper introduces a decentralized fundraising platform that utilizes blockchain technology and smart contracts to ensure transparency, security, and trust in financial transactions. The system features a machine learning-powered recommendation engine and supports cryptocurrency payments for seamless international transactions. By streamlining the fundraising process and reducing inefficiencies, this platform aims to make charitable giving more accessible and reliable	Security, Transparency	Enhanced transparency, Secure transactions	Dependency on blockchain infrastructure
7	2022	"TrustfulCharity Foundation platform based on Hyperledger Fabric"	"Artem Barger et al.	The Trustful Charity Foundation is a blockchain-powered charity platform built on Hyperledger Fabric, designed to enhance transparency, trust, and efficient fund distribution. By leveraging blockchain's immutability and traceability, the platform helps prevent fraud and misallocation of resources, allowing donors to monitor their contributions in real time	Increased Transparency , Enhanced Trust	Builds trust and transparency	High resource requirements, Limited decentralization
8	2021	"Karma - Blockchain Based Charity Foundation"	"Gubaev Renat et al."	This paper introduces "Karma, a blockchain-based charity donation platform" using Hyperledger Fabric to enhance transparency and trust in philanthropy. It offers secure, traceable transactions, real-time donation tracking, and smart contracts for transparent fund management, addressing issues like fraud and inefficiency while promoting	Trust, Transparency	Improved efficiency, Transparency	Lack of Transparency
9	2021	"A Secured Distributed Ledger Based Fundraising Framework Using Smart Contracts"	"Darshan MSR et al."	This paper proposes blockchain powered crowdfunding platform using smart contracts to ensure transparent, secure, and traceable transactions. It addresses trust issues and enhances charitable giving with features like tax benefits and donor rewards.	Traceability, Immutability	Increased transparency and accountability in charity systems, Enhanced trust factor for donors	Limited reach in regions with low internet penetration
10	2021	"Blockchain and Its Implementation for Charitable Organization's"	"Iqra Khalil et al."	This paper presents a This paper introduces a blockchain driven framework tailored for charitable organizations to enhance trust, transparency, and efficiency in managing donations. Built on Ethereum's Proof of Authority (PoA) consensus and smart contracts, the system ensures secure, traceable transactions and clear fund distribution. Its key features include real-time donation tracking, tamperproof records, and automated donor notifications, fostering greater accountability. By addressing fraud and inefficiencies, this platform aims to transform the charity sector with a reliable and transparent solution.	Transparency Decentralization	Immutability High transparency	Limited Scalability

S. No	Year &Journal	Title	Author	Description	Metrics	Advantages	Disadvantages
11	2021	"A Track Donation System Using Blockchain"	"Eisa Shaheen et al."	This paper introduces a blockchain powered donation system designed to improve trust, transparency, and cost efficiency in charitable giving. By utilizing decentralized ledger technology and smart contracts, the system guarantees secure, trackable transactions and ensures fair fund distribution Key features include real time donation tracking, immutable transaction records, and comprehensive donor reports, promoting accountability. By addressing fund mismanagement and transparency concerns, this solution aims to establish a more reliable and efficient donation model	Transparency ,trust, efficiency	User privacy, High transparency, Secure data integrity	High Implementation Complexity
12	2020	"Aid, Charity, and Donation Tracking System Using Blockchain"	"Aashutosh Singh et al."	This document presents a decentralized donation tracking system developed on the Ethereum blockchain, incorporating smart contracts to facilitate secure and transparent transactions. The platform bridges the gap between donors, NGOs, and government entities, offering key features such as donation traceability, tokenized contributions, and real -time tracking. By integrating these elements, the system aims to increase transparency, reduce corruption,	Improved efficiency, Transparency	Transparency, Traceability, Security, Reduced Corruption, Decentralization	Gas Fees for Transactions, Immutability Challenges
13	2020	"Developing a Reliable Service System of Charity Donation During the Covid -19 Outbreak"	"Hanyang Wu et al."	This paper introduces a blockchain -powered charity donation system designed to enhance transparency, trust, and efficiency, especially during crises such as COVID -19. Leveraging blockchain's decentralized and tamper -proof architecture, the system incorporates smart contracts to enable secure and traceable transactions. It aims to resolve trust issues, provide real -time fund tracking, and strengthen accountability. Key features include project monitoring, optimized resource distribution,	Transparency , Traceability	Decentralization , Enhanced trust, Secure transactions	Slower transaction processing, Potential centralization
14	2019	Proposed Solution for Trackable Donations using Blockchain"	N. Sai Sirisha et al.	This paper presents "Charity -Chain," a blockchain -powered platform built on Ethereum to enhance transparency and accountability in charitable donations. By integrating smart contracts and IPFS, the system ensures secure and traceable transactions while actively engaging stakeholders such as charities, government authorities, and retailers. Future developments focus on scalability and broader adoption through decentralized applications (Dapps)	transparency, traceability.	High computational costs , gas costs.	Limited reach in regions with low internet penetration
15	2019	"Platform for Tracking Donations of Charitable Foundations Based on Blockchain Technology"	Hadi Saleh et al.	This paper explores a blockchain -based platform to track charitable donations, ensuring transparency, security, and donor trust. Using Ethereum, smart contracts, and centralized storage, it streamlines reporting and fund management for charities. The project is part of a government initiative in Russia tracking, tamperproof records, and automated donor notifications, fostering greater accountability. By addressing fraud and inefficiencies, this platform aims to transform the charity sector with a reliable and transparent solution.	transparency, trust, tracking integrity	Energy inefficiency, slower data recording.	Limited Scalability

III. Issues and Challenges In Charity Process Using Blockchain

Charitable donation platforms, especially those based on traditional or early blockchain systems, face a range of challenges that impact their trustworthiness and effectiveness. Many existing solutions that adopted either Proof of Authority or Proof of Stake alone struggled to balance transparency, decentralization, and efficiency. While PoA systems offered speed, they often lacked decentralization, placing too much control in the hands of a few validators. On the other hand, Proof of stake systems provided better decentralization but sometimes suffered from slower transaction speeds and scalability issues. In addition to these technical limitations, these systems often lacked real-time fund tracking, clear verification mechanisms, and strong fraud prevention tools. High administrative overhead, delays in fund distribution, and limited accessibility further discouraged donor participation. These ongoing problems reduce public trust and prevent donations from reaching the people who need them most, highlighting the need for a more balanced and reliable solution.

IV. Conclusion

The integration of blockchain technology into the charity donation ecosystem introduces a paradigm shift toward a transparent, decentralized, and accountable framework. This research presents a complete solution aimed at enhancing the integrity of the donation process by recording each transaction on an immutable ledger, thereby eliminating concerns regarding misuse and lack of transparency. By utilizing smart contracts and a decentralized ledger, the proposed system ensures that every contribution is traceable and reaches its intended recipient without relying on third-party intermediaries. This builds trust among donors, improves fund management for NGOs, and provides clear visibility for beneficiaries. The implementation of this blockchain-based donation platform establishes a solid foundation for innovation in the non-profit sector. Planned future developments include the integration of a secure payment gateway, feedback and rating mechanisms for donors, and a centralized dashboard for NGOs to showcase project status and fund utilization.

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