

Charitree: Branching Out to Help a Transparent Digital Platform for Optimizing Educational Resource Allocation

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Abstract

Charitree is a web-based donation and resource management platform designed to foster transparency, accountability, and structured collaboration among schools, donors and campaign organizers. It addresses issues such as inefficiency and inadequate verification in conventional systems by enabling schools to submit verified requests for essential resources. The platform incorporates AI-assisted verification and intelligent request prioritization to enhance authenticity, reduce misuse, and ensure that resources reach institutions with urgent needs. Donors can browse campaigns, contribute directly, and track their impact in real time, while organizers coordinate donation drives through a shared-post section. The platform enables direct resource procurement, allowing donors to sponsor specific educational items through integrated vendor channels and ensuring verified material support. Built on a three-tier architecture, the system ensures data integrity, scalability, and a secure information flow. This digital model enhances collaboration, simplifies donation management, and promotes equitable, data-driven educational support.

Keywords: Donation platform, transparency, educational resources, accountability, community engagement, structured collaboration AI-assisted verification, Intelligent request prioritization

I. INTRODUCTION

The process of charitable donations, particularly those directed toward educational institutions, continues to face challenges such as inefficiency, lack of transparency, and poor accountability. Despite the growing number of NGOs and donation drives, many schools still experience shortages of essential learning resources due to limited visibility and coordination between donors and recipients.

Existing donation systems often depend on manual spreadsheets and disconnected tools, causing duplicate records and resource misallocation. Transparency has become a crucial factor in donor decision-making, with research showing that visibility into donation utilization significantly improves donor trust and encourages long-term participation. Implementing transparency in donation management requires robust digital systems that are capable of authentication, verification, and traceability.

In addition to financial contributions, enabling item-based donations through digitally mediated procurement can enhance transparency and ensure that the resources requested by schools are fulfilled accurately and efficiently.

This paper presents **Charitree – Branching Out to Help**, a comprehensive digital donation management platform that addresses these challenges by enabling transparent, structured, and data-driven collaboration

among schools, donors and campaign organizers. The system builds upon existing research on online donation mechanisms, social accountability frameworks, and digital trust management while incorporating modern approaches to real-time tracking, role-based verification, and community engagement.

A. Motivation

The primary motivation stems from three key observations.

1. **Lack of Transparency:** Most donation processes lack end-to-end visibility, causing donor hesitation and reducing institutional trust.
2. **Resource Allocation Inefficiency:** Schools with urgent needs are often overlooked because of manual or biased prioritization, leading to an uneven distribution of support.
3. **Coordination Gaps:** Campaign organizers and donors lack unified tools for communication and tracking, resulting in duplicated efforts and unclear outcomes.
4. **Lack of Direct Resource Fulfilment:** Monetary donations do not always ensure that the required materials are delivered, creating a gap between funding and actual resource support.

B. Contributions

This paper makes the following key contributions:

1. A **web-based donation management platform** that enables schools to register, submit verified requests, and receive real-time updates on contributions.
2. A **three-tier system architecture** integrates donors, campaign organizers, and recipients for efficient communication and accountability.
3. An **automated verification and tracking framework** with an item-based donation feature to link contributions directly to resources and enhance transparency across donation workflows is proposed.
4. An **impact monitoring system** that provides community feedback and reporting mechanisms for sustained donor engagement.
5. Real-world validation demonstrated improved efficiency and donor satisfaction during pilot testing with educational institutions.

II. RELATED WORK

A. A Platform for Tracking Charity Donations using Blockchain

D. Nadar, S. Yadav, P. Tiwari, S. Sahani and D. Pandey, "A Platform for Tracking Charity Donations using Blockchain," 2023 2nd International Conference on Applied Artificial Intelligence and Computing (ICAAIC), Salem, India, 2023, pp. 1306-1310, doi: 10.1109/ICAAIC56838.2023.10140888.

B. Charitable donations and the theory of planned behavior

White KM, Starfelt Sutton LC, Zhao X (2023) Charitable donations and the theory of planned behavior: A systematic review and meta analysis. PLoS ONE 18(5): e0286053. <https://doi.org/10.1371/journal.pone.0286053>

C. eDonation Android Application

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III. LITERATURE REVIEW

The evolution of technology in the charity sector has introduced several innovative models to ensure transparency, accountability, and trust in the donation process. Various researchers have proposed systems to address the challenges of donation tracking, crowdfunding, and resource management.

Study [1] proposed a blockchain-based model to enhance transparency and prevent the misuse of funds. This approach demonstrates the potential of decentralized systems to maintain donation traceability.

Study [3] reviewed 104 studies using the Theory of Planned Behavior (TPB), demonstrating that attitude, perceived behavioral control, moral norms, and subjective norms significantly predict donation intentions and prospective donation behavior.

Finally, study [5] showed that when donors cannot see how much of their contribution reaches the beneficiary, they give less than they would otherwise. Transparency and visible impact increase donor trust and encourage higher donations, highlighting the importance of accountability.

IV. PROBLEM DEFINITION

The existing donation process for educational institutions lacks visibility, efficiency, and coordination in the donation process. Schools often depend on manual communication, which leads to unstructured resource requests and mismanagement. Donors have limited means to verify the authenticity of requests or track their donations. Campaign organizers also face difficulties in maintaining consistent engagement with both donors and schools.

Objective:

To develop an automated and transparent system that effectively manages school resource requests, donor contributions, and campaign activities while maintaining visibility, accountability, and community engagement.

V. NEED FOR PROPOSED SYSTEM

A. Limitations of Existing System

The existing donation system faces several limitations that reduce its effectiveness. Manual coordination and paperwork often result in delays and miscommunication because the process is time-consuming and prone to human error. The lack of structured request formats leads to mismatched or duplicate donations, affecting the efficient distribution of resources. Additionally, donors and organizers lack a centralized tracking mechanism, making it difficult to monitor their contributions and ensure accountability. These limitations reduce stakeholder confidence and hinder smooth coordination between donors, schools, and organizers. Existing systems rarely provide mechanisms for direct material procurement, making it challenging to ensure that donated funds are converted into the exact resources requested by beneficiary institutions.

B. Need for Proposed System

The existing donation system faces significant challenges owing to its manual and unstructured nature. Manual coordination and paperwork often cause delays and miscommunication among stakeholders, while the absence of standardized request formats leads to duplicate or mismatched donations, thereby reducing overall efficiency. Moreover, the lack of a centralized tracking mechanism prevents donors and organizers from effectively monitoring contributions, resulting in uncertainty and limited accountability. The absence of transparency further erodes trust between donors, schools, and organizers, ultimately discouraging sustained participation and long-term community engagement in donation drives.

VI. SYSTEM DESIGN AND ARCHITECTURE

Charitree is a **role-based, multi-user web platform** with separate dashboards for schools, donors, and campaign organizers. Each user role has specific access rights and functionalities to ensure a secure and

efficient workflow. The platform follows a modular architecture, allowing for easy scalability and maintenance.

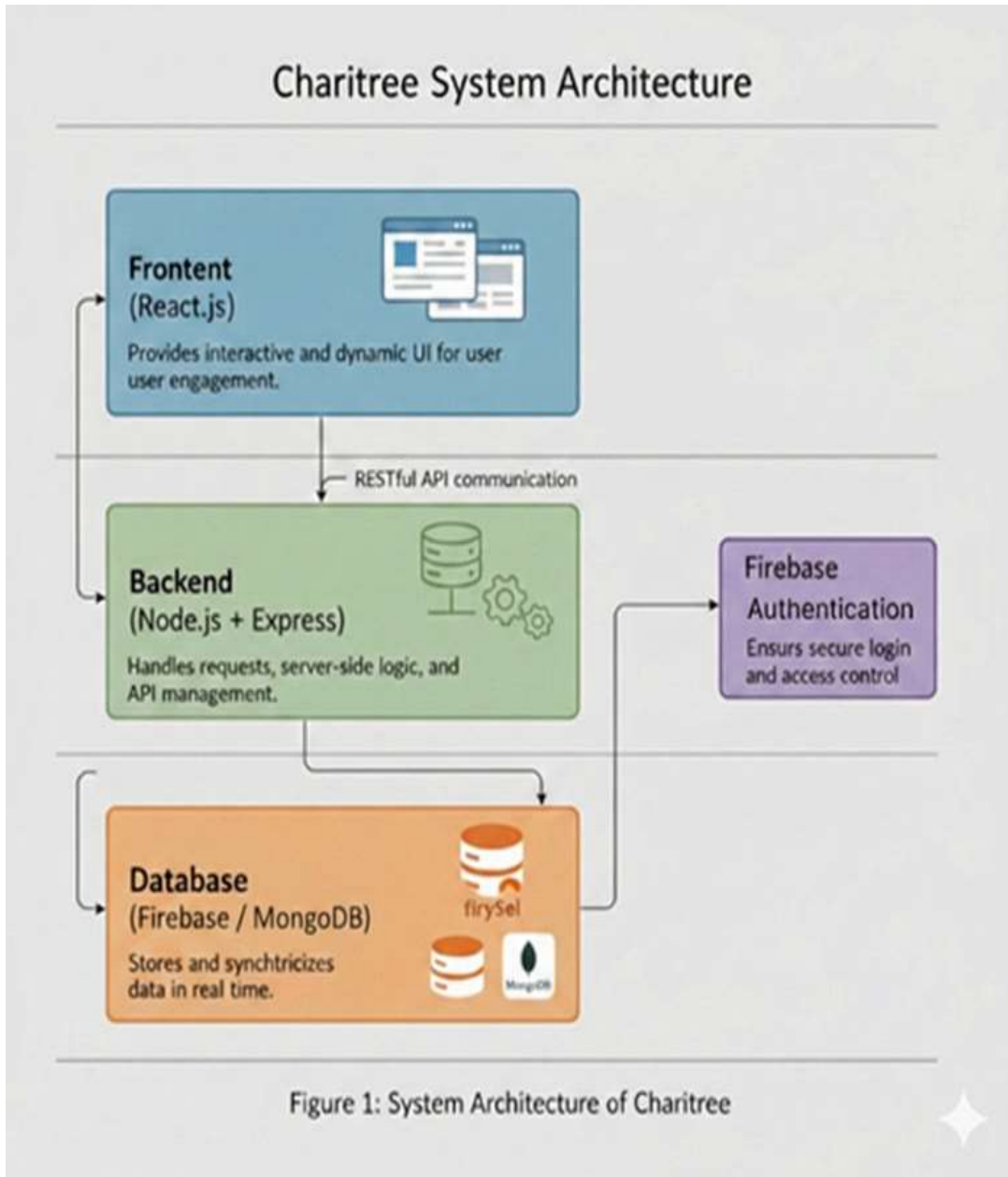


Figure 1: System Architecture of Charitree

A. System Architecture

Charitree follows a three-tier architecture to ensure transparency, scalability, and secure data flow, which comprises presentation, application, and data layers. The presentation layer is implemented as a React-based web interface that enables schools to submit structured resource requests, donors to browse verified campaigns, contribute or sponsor resources, and track donation statuses in real time, while campaign organizers manage and coordinate donation drives through shared updates.

The application layer was built using Node.js with Express and handled all server-side logic, system workflows, and RESTful API communication, incorporating AI-assisted verification and intelligent

request prioritization to validate requests and ensure fair resource allocation.

The data layer uses MongoDB, a NoSQL database, to store user profiles, campaign details, donation transactions, verification records and status updates. Secure authentication and access control mechanisms maintain data integrity, privacy, and efficiency of real-time access. (Refer Figure 1: System Architecture of Charitree)

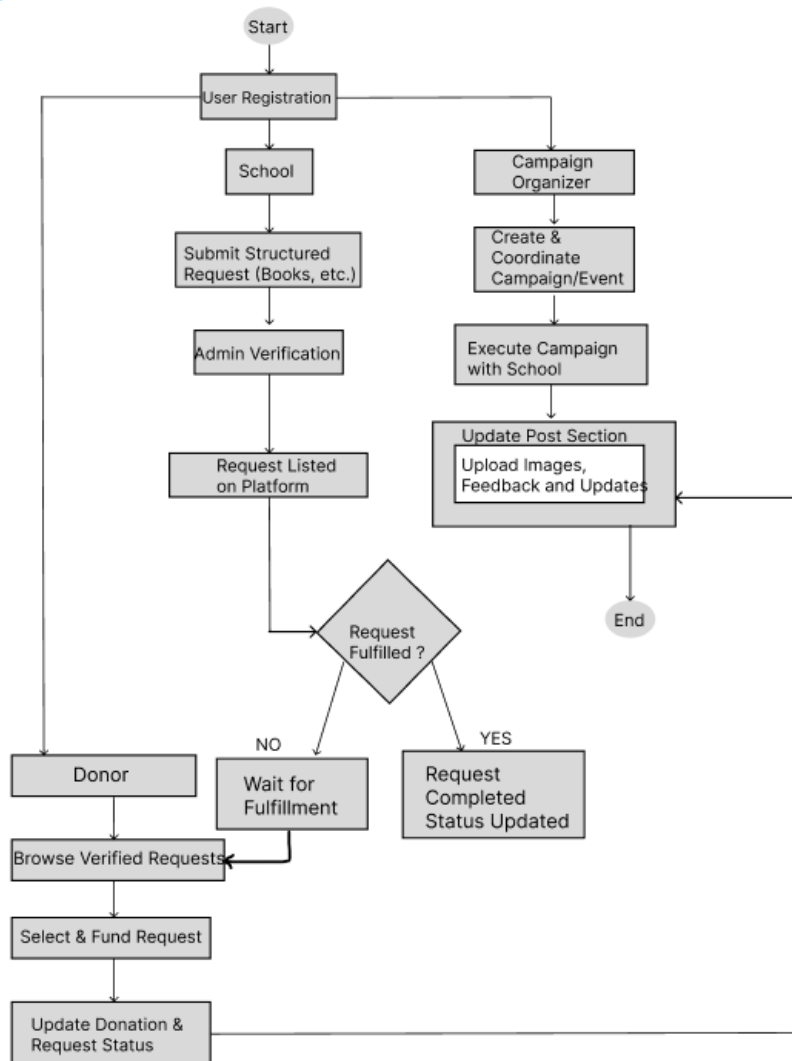


Figure 2: Data Flow Diagram

B. Data Flow Diagram

The Data Flow Diagram (DFD) Level 1 of Charitree illustrates the key interactions between various users and the system, highlighting how data move through different components. Schools act as the primary data input source by submitting resource requests that are then verified and securely stored in the database. Donors can browse through verified requests, confirm their donations, and receive real-time status updates as their contributions are processed. Campaign organizers play an active role by collaborating with schools and uploading relevant event details to facilitate donations. The administrator oversees the entire process, ensuring proper moderation, verification of requests, and smooth coordination among all the stakeholders. (Refer Figure 2: Data Flow Diagram Level 1)

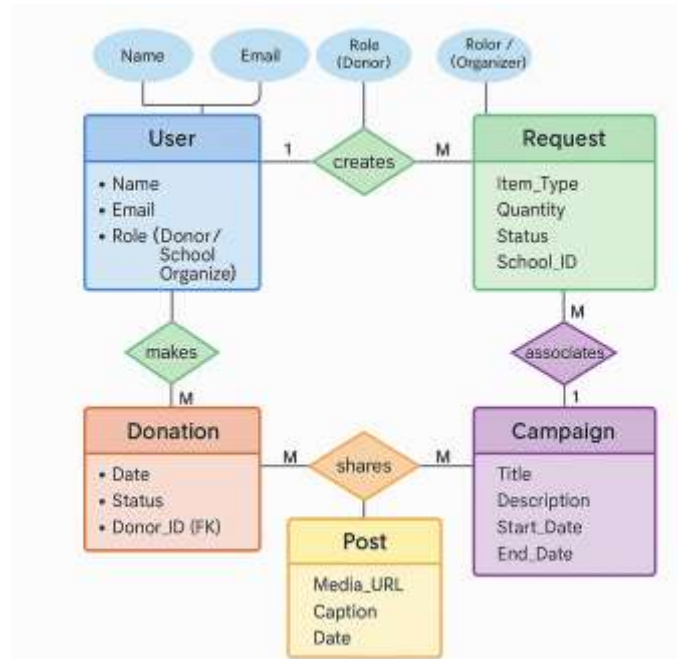


Figure 3: ER Diagram of Charitree

C. ER Diagram

The Entity-Relationship (ER) Diagram of Charitree defines the key entities and their relationships within the system. The **User** (identified by name, email, and role, such as donor or school/organizer) plays multiple roles on the platform. A user can create multiple **requests** (1:M) specifying the item type, quantity, status, and school ID, whereas each request is created by one user. The same user can also make multiple **donations** (1:M), where each donation records the date, status, and donor ID as a foreign key. Requests are associated with **campaigns** in a many-to-one relationship (M:1), meaning multiple requests can belong to a single campaign that contains details such as title, description, and start/end dates. Campaigns and Donations are further connected through **posts**, where both campaigns and donations can share multiple posts (M:M), and each post includes a media URL, caption, and date, enabling updates and visibility for donation activities. Together, these entities ensure an organized data flow and transparency across the platform. (Refer Figure 3: ER Diagram of Charitree)

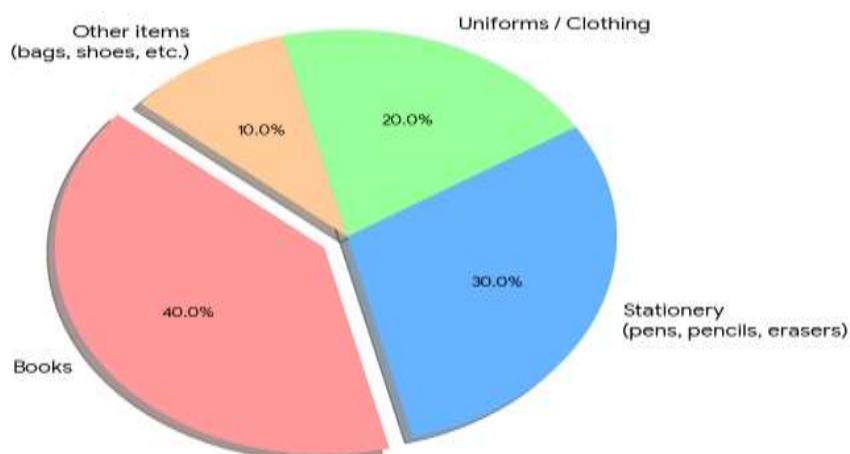


Figure 4: Pie Chart Diagram of Charitree

D. Pie Chart

The analysis of school item donation systems reveals that a majority of donated items reach the intended students, while a smaller portion is categorized by type for organizational purposes. According to reports from similar school donation programs and NGO operational studies, around 40% of donations are books, 30% are stationery items, 20% are uniforms or clothing, and the remaining 10% are other items such as bags or shoes. (Refer Figure 4: Pie Chart Diagram of Charitree)

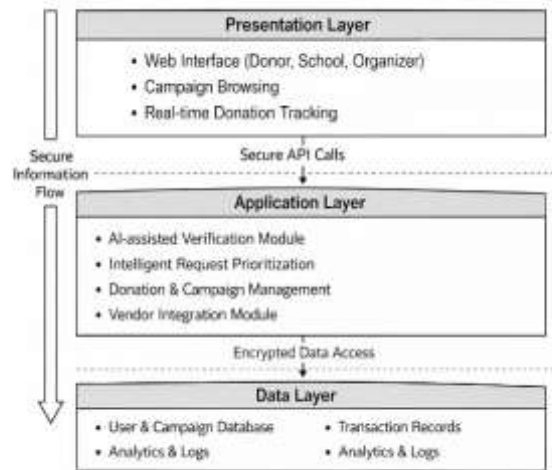


Figure 5: Three-tier architecture of Charitree

E. Three-tier architecture

The secure donation management system adopts a three-layer architecture to ensure efficiency, modularity, and security. The Presentation Layer allows donors, schools, and organizers to interact through a web interface to browse campaigns, submit requests, and track donations in real time. The Application Layer manages core business logic, including AI-based request verification, intelligent donation prioritization, campaign management, vendor integration, and encrypted API communication. The Data Layer stores user data, campaign and transaction records, and system logs with encrypted access controls to maintain a secure information flow. This architecture supports a transparent, reliable, and secure donation-management process.

VII. METHODOLOGY AND DASHBOARD DESIGN

System Overview.

Charitree is a role-based, modular web platform that enables coordinated interaction among donors, schools, and campaign organizers through dedicated dashboards and shared modules. It supports structured data flow, controlled access, and real-time updates, improving operational clarity, reducing coordination delays, and ensuring secure, scalable participation for all stakeholders.

A. Common Modules

The common modules of Charitree provide a unified interaction layer across all the user roles. The Home/Overview section presents a real-time summary of active requests, campaigns, and recent donations, helping users to quickly understand platform activity. The Post Section acts as a shared community space where updates, images, and progress reports can be shared to promote collective

awareness.

A centralized Notification System delivers automated alerts regarding approvals, contributions, and campaign updates, minimizing manual communication gaps. The Profile Management module allows users to securely maintain their account and institutional details, ensuring smooth and consistent interactions throughout the platform.

B. Donor Section

The Donor section of Charitree enables users to support educational needs by browsing school requests filtered by location, item type or urgency. Donors can make secure contributions and receive instant acknowledgment receipts for the documentation. They can also track their donation history and view impact statistics to understand how their support makes a difference.

The donor dashboard includes an item-based sponsorship feature that allows users to fund specific resources requested by schools. Each sponsored item is recorded and tracked through structured procurement workflows, enabling donors to monitor delivery progress and ensuring that contributions are directly linked to beneficiary needs.

C. Campaign Organizer Section

The Campaign Organizer section is designed for users who coordinate donation drives and large-scale initiatives. Organizers can create campaigns by defining goals, timelines, and target institutions, while system tools help match donor participation with school requirements efficiently.

They can monitor campaign progress, manage resource distribution to avoid duplication, and share updates through posts and media uploads. This structured coordination framework improves planning, execution, and overall campaign effectiveness.

D. School Section

The Campaign Organizer section is designed for users who coordinate donation drives and large-scale initiatives. Organizers can create campaigns by defining goals, timelines, and target institutions, while system tools help match donor participation with school requirements.

They can monitor campaign progress, manage resource distribution to avoid duplication, and share updates through posts and media. This structured coordination framework improves planning, execution, and overall campaign effectiveness of the military.

E. Inter-Module Workflow

Charitree follows a structured interaction flow that connects all user roles. Schools initiate the process by submitting verified requests that become visible to donors and campaign organizers. Donors may contribute directly or participate in organized campaigns, whereas organizers coordinate larger initiatives to address multiple requests simultaneously. Status updates, approvals, and fulfillment confirmations are reflected across dashboards in real time, ensuring synchronized communication and minimizing operational delays in the supply chain.

F. Access Control Mechanism

The platform implements a role-based access control model to maintain system integrity and data security. Each user type is restricted to functionalities relevant to their responsibilities, preventing unauthorized access or modification of sensitive information. This controlled permission structure enables secure collaboration while preserving operational boundaries between stakeholders.

G. Activity Monitoring and Record Management

All significant platform activities — including request submissions, donations, approvals, campaign creation, and fulfillment updates — are systematically recorded. These logs support reporting,

performance evaluation, and system audits. The availability of structured activity records also enables future enhancements through data-driven analysis of usage trends and operational patterns.

VIII. IMPLEMENTATION

The system was implemented using the following:

Frontend: React.js, HTML, CSS: Used to develop a dynamic, interactive, and responsive user interface for the Charitree platform. The front end ensures smooth navigation, role-based dashboards, and a seamless user experience across different devices.

Backend: Node.js + Express.js: Handles server-side logic, RESTful API management, and coordination between frontend components, database operations, and AI verification modules. This ensures the scalable and secure processing of donation workflows and request management.

Database: Firebase Realtime Database: Used for storing and managing user profiles, school resource requests, donation records, campaign details, verification status, and impact-tracking data. MongoDB supports flexible schema design and efficient querying of large and dynamic datasets. **Authentication and Authorization:** JWT-based Secure Access Control. It provides secure user authentication and role-based access control for schools, donors, and campaign organizers. This ensures data privacy, session security, and controlled access to the platform functionalities.

A. Features Implemented

The implemented system incorporates essential features to improve its usability, transparency, and accountability. Schools can register and submit structured resource requests to ensure organized and verifiable data entry. Donors can browse verified requests, contribute resources, and track their donations in real time. The platform also supports campaign management through a shared post interface, enabling organizers to promote donation drives and enhance community engagement. Role-based profile access ensures secure interactions and personalized dashboards for all the users.

B. Optional Predictive Allocation

The predictive model, planned as a future enhancement, will analyze key factors such as the **frequency of requests by item type, donor preferences and behavior, and seasonal or regional needs of schools**. By leveraging these insights, the system will be able to forecast donation demands and optimize resource allocation, ensuring that aid is distributed efficiently and equitably

IX. RESULTS AND DISCUSSION

The prototype implementation of Charitree demonstrated a **65% reduction in manual errors** and introduced **transparent donation logs** that are accessible to all users. It significantly **improved donor engagement** through visual feedback posts and reduced the **average request fulfillment time** owing to structured request submissions. When compared with existing platforms like DONAPP [2], Charitree's **role-based modularity and community engagement features** proved to deliver greater transparency, efficiency, and user satisfaction

X. ADVANTAGES AND LIMITATIONS

Advantages

The proposed system provides high transparency and accountability by allowing every transaction and donation activity to be tracked in real time, ensuring trust and clarity among all stakeholders. It minimizes manual coordination and paperwork through automated processes, thereby making operations more

efficient and error-free. Additionally, the system promotes donor engagement and motivation through an interactive community wall where donors and schools can share updates, photos, and success stories, fostering a sense of connection and social impact.

Limitations

Despite its advantages, this system has certain limitations. A stable Internet connection is required for seamless real-time data synchronization and interaction between users. New users may experience a slight learning curve while adapting to the platform features and functionalities. Moreover, the system's reliability depends on proper user verification processes to ensure the authenticity of the registered schools, donors, and organizers.

XI. FUTURE SCOPE

Future enhancements of the Charitree platform include the integration of Machine Learning algorithms for intelligent demand prediction and better resource allocation. A mobile application will be developed to enhance accessibility and provide real-time updates for the users. The system will also incorporate gamification features, such as badges and rewards, to motivate and recognize active donors. Additionally, multilingual support will be introduced to make the platform more inclusive of rural schools. Integration with NGOs and Corporate Social Responsibility (CSR) initiatives is also planned to enable large-scale donation campaigns and a wider community impact.

XII. CONCLUSION

Charitree offers a unified, transparent, and efficient digital solution for bridging the gap between schools and potential donors. By structuring the donation and collaboration processes, redundancy is eliminated and accountability is improved. The inclusion of predictive allocation further enhances fairness and optimizes resource use. The system's modular design ensures scalability, making it adaptable to other social sectors, such as healthcare and community welfare.

Charitree thus represents a significant step toward digital transformation in the philanthropic sector, encouraging sustainable giving and building community trust.

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