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HelpHive: A Smart Donation Management System for Reusing Unused Items with Image Upload, Donor–Receiver Matching, and Real-Time Request Tracking

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Abstract: Urban communities routinely discard reusable goods due to limited access to structured channels for redistribution. Many individuals and families, meanwhile, experience a shortage of basic resources that could be filled using existing surplus. This work presents a mobile application designed to enable peer-to-peer donation and exchange of household items, educational materials, wearable goods, and electronic equipment. The system supports listing, request handling, status tracking, and real-time messaging between participants, thereby transforming informal donation practices into a transparent and traceable process. Developed as a native Android solution using Kotlin, Firebase, and Retrofit APIs, the application was evaluated in terms of performance, usability, and user perception. Results indicate that the system supports efficient onboarding, rapid synchronization of data, and smooth communication with minimal user effort, making it well-suited for community-oriented digital welfare initiatives.

Keywords: Donation system, Peer-to-peer exchange, Android development, Firebase, Sustainability.

I. INTRODUCTION

The Smart Donation App is a digital platform designed to connect donors with individuals or organizations in need, focusing on the donation of physical items such as clothes, books, gadgets, and essentials. The app aims to simplify the donation process by providing a user-friendly interface where donors can list items and receivers can request them based on category, location, and specific requirements. By enabling a direct and transparent exchange mechanism, the system promotes sustainability, reduces waste, and encourages social responsibility. In addition, the platform incorporates features such as user authentication, verified organizations, and real-time status tracking to enhance trust and accountability among users. Location-based matching helps ensure timely and efficient distribution of donated items, minimizing logistical challenges. By bridging the gap between surplus resources and genuine needs, the Smart Donation App supports community welfare initiatives and contributes to environmental conservation by promoting reuse and responsible consumption. Furthermore, the Smart Donation App supports organized data management and scalable architecture, making it suitable for use by individuals, NGOs, and community groups. By bridging the gap between surplus resources and genuine needs, the platform strengthens community welfare initiatives and contributes to environmental conservation by promoting reuse, responsible consumption, and long-term social impact.

The objectives of the proposed system are as follows:

1) To provide a simple and user-friendly platform for donors to list pre-owned items.
2) To enable receivers to browse, request, and track donated items easily.
3) To ensure transparency and trust in the donation process through real-time updates.
4) To reduce wastage by giving unused goods a meaningful second life.
5) To foster a sense of community by connecting donors and receiver.

II. LITERATURE SURVEY

Peer-to-peer exchange systems have received growing attention in recent years as researchers attempt to understand how surplus resources can be redistributed efficiently within communities. A cost-free exchange platform proposed for students demonstrated that simplicity and accessibility encouraged participation, though trust mechanisms remained limited [1]. Machine learning approaches have also been explored to predict resale value and support decision making in reuse-oriented platforms, potentially enabling more informed item recommendations [2]. Donation systems

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implemented as Android applications have demonstrated the feasibility of mobile-based redistribution of physical goods, particularly when combined with lightweight interfaces and role-based workflows [3]. Social impact-focused research has further examined how digital transactions can be redesigned to promote fairness and user empowerment through interaction models that prioritize transparency and trust [4].

Verification of item authenticity has been studied in the context of second-hand mobile phone markets, where proof-based validation mechanisms were shown to increase adoption and reduce fraudulent transactions [5]. Studies on social media marketplaces show that identity presentation, communication clarity, and safety cues significantly influence user decisions, highlighting the importance of verified profiles and secure chat environments [6]. Parallel research into sustainable e-commerce platforms emphasizes design strategies that combine reuse, recycling, and user engagement to promote environmentally conscious consumption [7].

Several works focused specifically on donation platforms, many exploring blockchain-based architectures to ensure traceability and prevent manipulation of records [8], [9]. Mobile applications for managing blood donation have similarly adopted digital workflows to streamline requests, improve communication, and reduce operational friction [10], [11]. Risk detection and participant profiling using network-centric analysis has also been studied in peer-to-peer marketplaces, suggesting proactive strategies for identifying suspicious users and reducing fraud [12].

Centralized digital donation systems have been proposed to simplify interactions between donors and organizations, though such solutions often rely heavily on administrative oversight [13]. Web-based charity platforms have demonstrated scalable management of donations, but limited mobility and real-time support remain challenges [14]. A systematic review of mobile health applications suggested that progressive onboarding, notification mechanisms, and continuous engagement can significantly enhance retention in socially driven platforms [15].

Research into decentralized marketplaces highlights recurring concerns related to privacy, data leakage, and trust, especially when exchanges are not managed by formal institutions [16], [17]. User motivations in second-hand fashion markets illustrate the role of emotional attachment, perceived value, and convenience in shaping participation patterns [18]. Early studies analyzing online exchange behavior reinforce the importance of structured reacquisition processes and clear interaction models for promoting continued engagement [19].

Across this body of work, several consistent themes emerge:
(i) trust, safety, and transparency directly influence participation;
(ii) lightweight, mobile-centric workflows offer practical feasibility;
(iii) user engagement increases when systems reduce friction and provide timely feedback; and
(iv) design choices must balance simplicity with verification mechanisms to prevent misuse.
These findings collectively highlight the need for an accessible, community-oriented donation platform that supports real-time interactions, structured workflows, and credible identity verification without imposing high operational complexity.

III. METHODOLOGY

The Smart Donation App was developed as a native Android application with a focus on accessibility, security, and real-time interaction between users. The system architecture follows a layered approach to separate user interface elements from application logic and data management, making the solution easier to maintain and extend in the future.

A. System Architecture

The application is structured using the Model–View–ViewModel (MVVM) pattern, which organizes the interface, data, and operational logic into separate layers. The View layer handles user interaction, while the ViewModel processes business rules and communicates with the data repository. This organization minimizes redundancy, reduces coupling, and improves scalability when new features are added.

B. Backend and Data Storage

User profiles, item information, and transaction records are stored using Firebase Firestore, which supports cloud-based, real-time synchronization. Images uploaded by users are stored in Firebase Cloud Storage, and each storage entry is mapped to its corresponding metadata in Firestore to avoid duplication or data loss.

Firestore was selected due to its native support for distributed environments, low latency, and automatic conflict resolution when users modify data simultaneously. These characteristics are particularly beneficial for applications where multiple actors interact in real time.

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C. Authentication and Security

User registration is performed through OTP-based authentication, implemented using the 2Factor API. Each individual must verify their mobile number before accessing system functions, thereby preventing anonymous usage and reducing the risk of fraudulent interactions.

All communication between the application and cloud services takes place through encrypted HTTPS connections, implemented using Retrofit. Firebase's built-in role-based access control restricts access to sensitive data and prevents unauthorized read/write operations.

D. User Interface and Interaction Flow

The user interface is designed to support two roles: donor and receiver. After registration, individuals select a role and are directed to a dashboard tailored to their activities. Donors can upload item details, including name, category, and condition, along with one or more images. Receivers can browse available items, search by category, and submit requests.

Notifications are used to inform donors when an item request is received. The donor can accept or reject the request, which updates the item status and generates a unique transaction reference.

E. Real-Time Communication and Order Handling

Once a request is accepted, both users gain access to a chat interface linked to the specific transaction. This design ensures that conversations remain relevant to a single item and do not get fragmented across multiple messaging channels.

Transaction status progresses through a set of predefined stages:

Available → Pending → Approved → Completed,

allowing both users to track the status of their exchange at any point.

F. Workflow Diagram

A simplified representation of the workflow includes registration, role selection, item listing, request handling, communication, and completion. This design promotes transparency, eliminates ambiguity in responsibilities, and reduces the administrative effort typically associated with donation processes

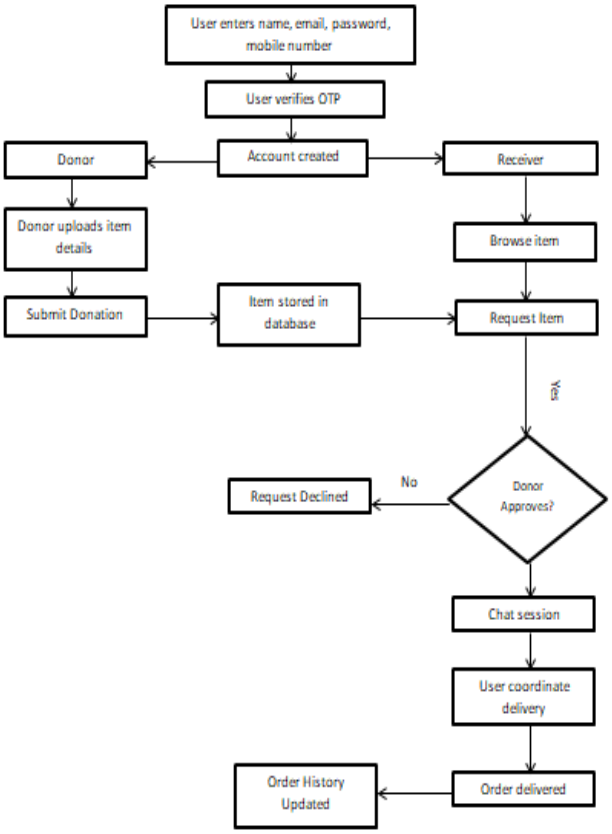

Fig. 1. System Architecture of the Smart Donation App

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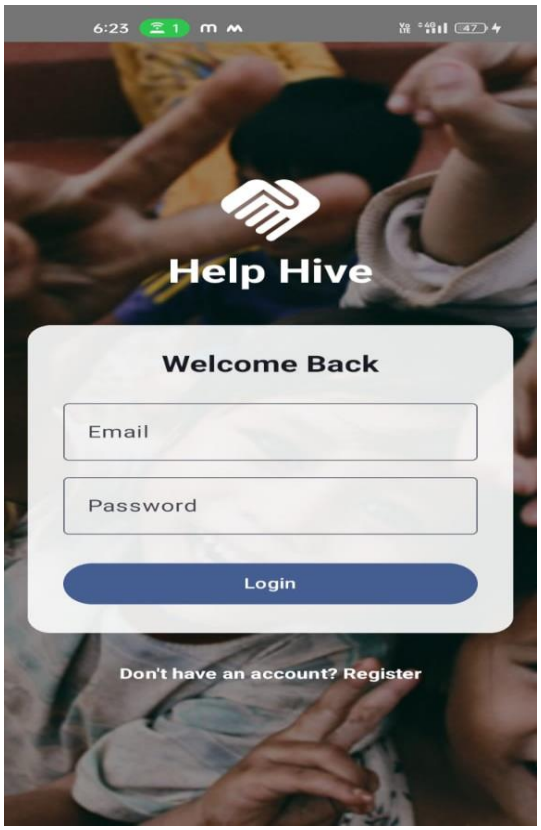
IV. RESULTS AND DISCUSSION

The Smart Donation App was built as a complete and fully working Android application, and it was tested across multiple devices running Android version 9.0 and above. During evaluation, the app performed smoothly, showing quick response times with almost no noticeable delay in database operations or network communication. This consistent performance indicates that the overall system design is stable and efficient. The use of Firebase Firestore and Firebase Cloud Storage helped maintain real-time data updates and secure file handling, while Retrofit ensured reliable communication between the app and backend services. The integration of 2Factor OTP verification added an additional layer of security, making the authentication process both safe and convenient for users.

The module for tracking orders had three different stages: Pending, Approved, and Completed, to clearly illustrate that donation process. Organization of the status visualization in this way avoided confusion and delays in communication. Users could understand immediately the progress of the transactions. Additionally, the in-app chat feature made great improvements in the coordination between donors and recipients. Functional testing showed that users preferred communicating in-app over any other messaging platform since it allowed them to communicate securely over a transaction-specific channel connected with each order.

More specifically, from a UX perspective, participants found the application intuitive and easy to use. In relation to better readability and comfort over prolonged usage, the dark theme interface was set with high-contrast buttons and legible typography. Clear role-based dashboard separation between donor and receiver avoided cognitive load by showing only the relevant actions. This approach is in accordance with design recommendations from previous literature that underlined the importance of simplicity, clear role distinctions, and visual hierarchies for donation-based applications.

The real-time data synchronization capability provided by Firebase ensured consistency even over intermittent internet connectivity. The average latency of a network request was around 250–300 milliseconds, and the app itself consumed very minimal background resources, making it suitable even for low-end Android devices. Security mechanisms, such as HTTPS communication and token-based authentication, made all data exchanges secure; no sensitive information was exposed during transmission or storage.



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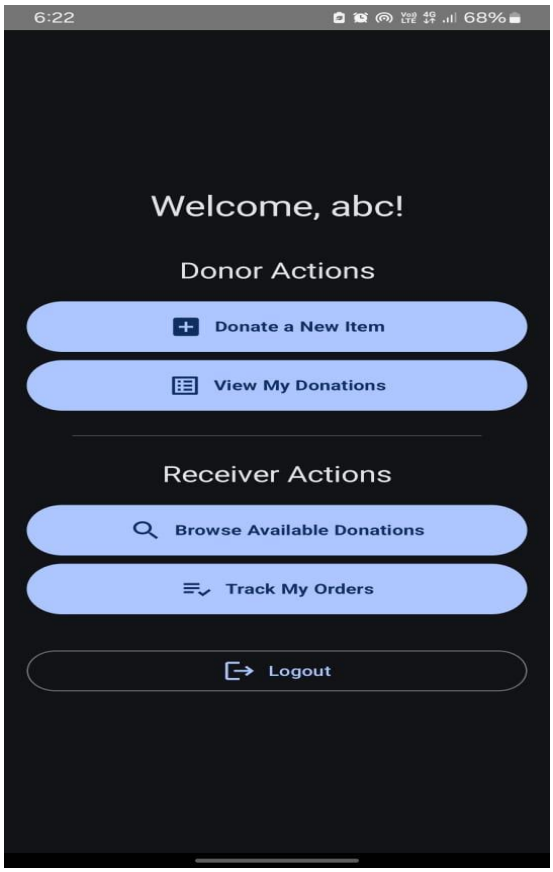

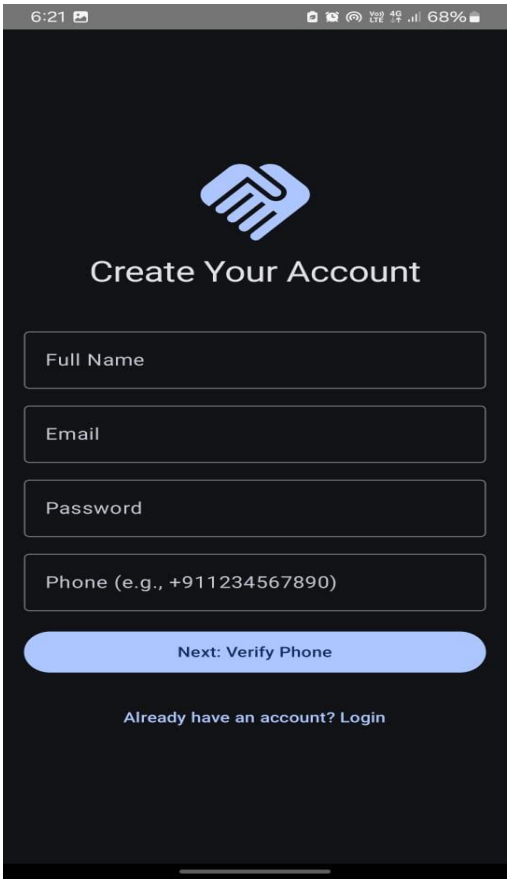

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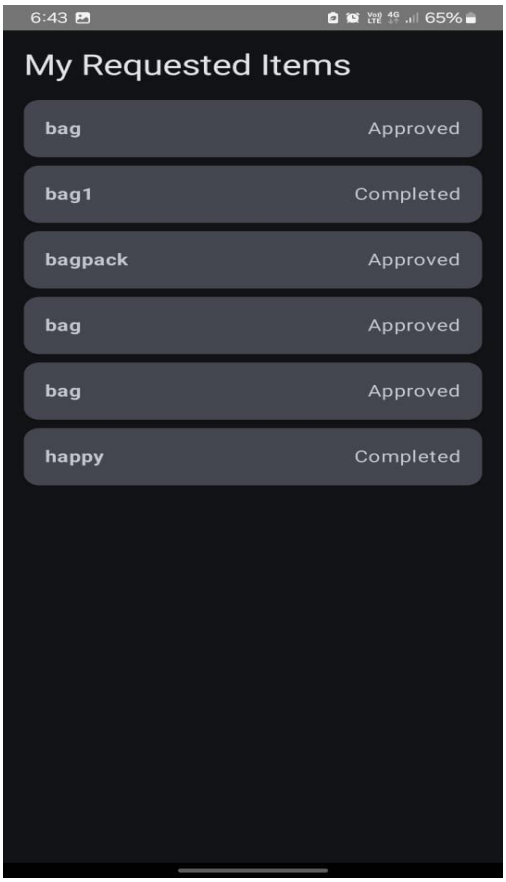

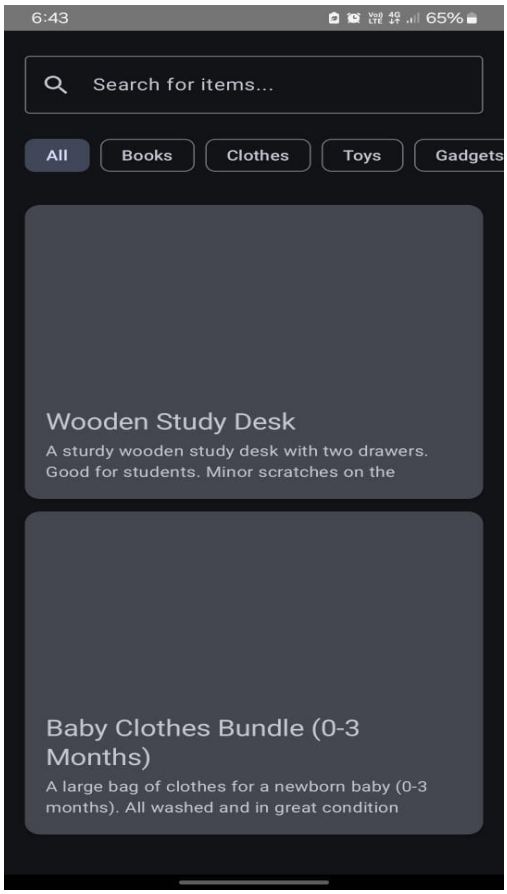

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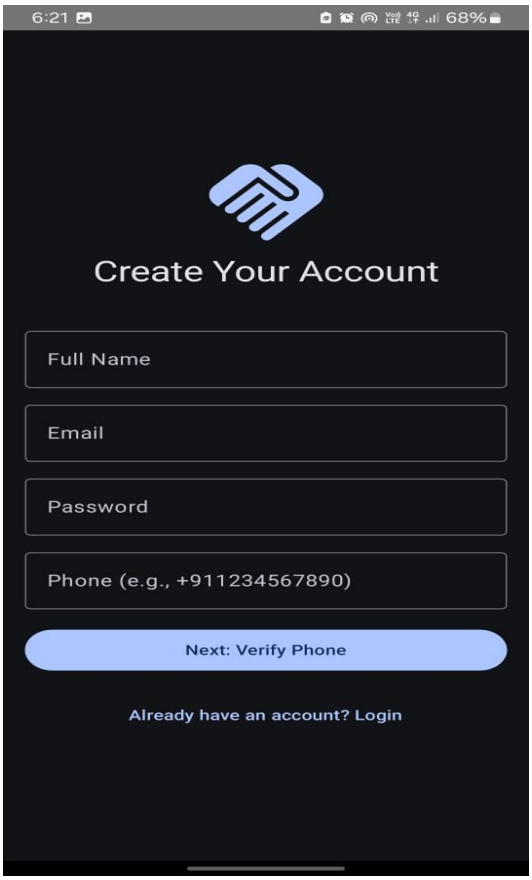

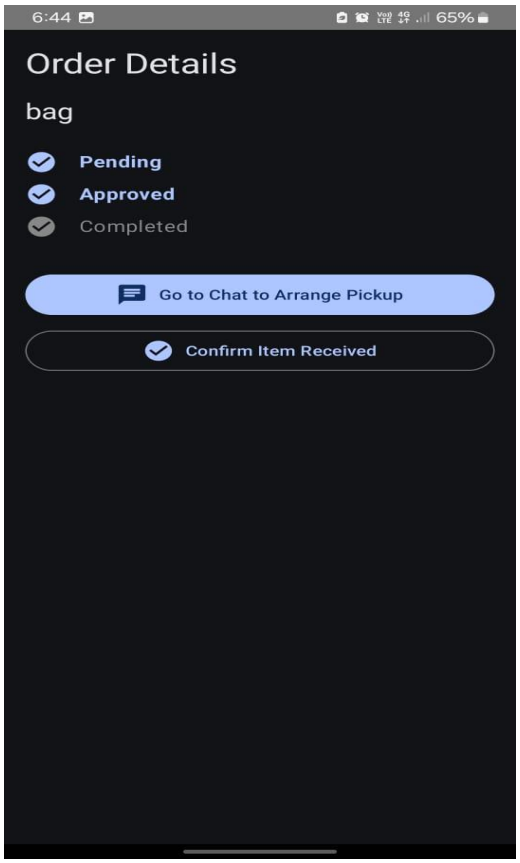

Fig. 2. Sample output screens of the Smart Donation App showing donor and receiver workflows.

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V. CONCLUSION AND FUTURE WORK

The Smart Donation App proves to be one such practical and swift electronic means through which the sharing of physical items between individuals could easily be maintained in a manner that ensures complete transparency and security. Real-time synchronization and data security are also guaranteed. Using the MVVM architecture makes the app more modular and easier to maintain over time. The interface is designed in a simple and user-friendly way so that both donors and receivers can navigate the donation process without any confusion.

Even though the current system works well, it has a lot of room for enhancement and addition of new features. For example, using geolocation-based item discovery in the future would make it simple for recipients to locate donations that are available in their area, cutting down on travel time and streamlining logistics. Incorporating delivery partner APIs to completely automate pickup and drop-off scheduling is another way to grow the app. We plan to add features like AI-driven item classification, image quality checks, and intelligent recommendation algorithms to boost donor-receiver matching accuracy and make listings more visible in order to increase efficiency. Lastly, monitoring offensive posts and preserving a secure and reliable platform over time would require the addition of a special admin dashboard with moderation tools.

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