Volhub: A Volunteer Management System for Effectively Managing Events

Aleena V Sunil
Computer Science and Engineering
St. Joseph's College of Engineering and Technology
Palai, India
aleenavsunil2026@cs.sjcetpalai.ac.in

Praveen Rajan
Computer Science and Engineering
St. Joseph's College of Engineering and Technology
Palai, India
praveenrajan2026@cs.sjcetpalai.ac.in

Steve Maruthoor Thomas
Computer Science and Engineering
St. Joseph's College of Engineering and Technology
Palai, India
stevemaruthoorthomas2026@cs.sjcetpalai.ac.in

Prof. Anju B
Computer Science and Engineering
St. Joseph's College of Engineering and Technology
Palai, India
anju@sjcetpalai.ac.in

***Abstract*—Volunteering plays a crucial role in addressing social challenges and supporting community development; however, many volunteering initiatives still suffer from poor coordination, limited communication, and lack of recognition for volunteer contributions. Traditional volunteer management platforms often provide basic event listings but fail to deliver personalized engagement, transparent evaluation, and efficient collaboration between volunteers and organizers. This paper presents VolHub, an intelligent mobile-based Volunteer Management System designed to enhance volunteer participation, improve v-match, and foster long-term engagement through advanced digital features.VolHub enables volunteers to create secure profiles showcasing their skills, interests, and experience, while organizations can publish detailed event announcements with clear requirements. Building upon existing volunteer management frameworks such as V-Vibe, the proposed system introduces several novel enhancements. A personalized recommendation system suggests suitable events based on volunteer profiles, participation history, and earned certificates. Performance ratings submitted by organizers after events contribute to a transparent volunteer reputation system. To motivate beginners, a starter badge mechanism is introduced for first-time volunteers, encouraging early participation.The system supports both paid and unpaid events, making it suitable for professionals seeking compensation as well as students and beginners aiming to gain experience. Integrated real-time chat, collaborative tools, and an interactive calendar improve coordination and scheduling. Gamification elements such as leaderboards, likes, and notifications further enhance engagement. VolHub is powered by Supabase services to ensure secure authentication, real-time data synchronization, and scalability. Experimental evaluation and user feedback indicate improved usability, communication efficiency, and volunteer motivation, demonstrating VolHub's effectiveness as a comprehensive digital solution for modern volunteer management.**

***Index Terms*—Volunteer Management System, v-vibe, v-match, Gamification, Supabase**

I. Introduction

Volunteering plays an essential role in social development by enabling individuals and organizations to collaborate for social, educational, and humanitarian causes. Despite the increasing interest in volunteering, many initiatives face challenges such as poor coordination, unclear event information, limited communication between stakeholders, and lack of proper recognition for volunteer contributions. These issues often lead to reduced participation, inefficient event execution, and low volunteer retention.

Traditional volunteer management approaches rely heavily on manual coordination or basic digital platforms that offer limited functionality. While some mobile-based Volunteer Management Systems (VMS) provide event listings and volunteer registration, they often lack personalized engagement, transparent performance evaluation, and real-time collaboration features. As a result, volunteers struggle to find opportunities aligned with their skills and interests, while organizations find it difficult to manage and motivate participants effectively.

Recent advancements in mobile technologies, cloud-based platforms, and real-time databases have opened new possibilities for developing intelligent volunteer management solutions. Features such as personalized recommendations, gamification, instant notifications, and performance analytics can significantly enhance volunteer engagement and organizational efficiency. However, most existing systems do not integrate these capabilities into a unified platform.

To address these limitations, this paper presents VolHub, a smart mobile-based volunteer management system designed to improve coordination, engagement, and transparency within volunteer communities. Building upon existing volunteer management frameworks, VolHub introduces intelligent event

matching, structured performance reviews, real-time communication tools, and gamified incentives. The proposed system aims to transform volunteering into a more organized, rewarding, and impactful experience for both volunteers and organizations.

II. Related Work

Volunteer management systems have evolved significantly over the past decade with the adoption of web and mobile technologies. Early platforms primarily focused on listing volunteer opportunities and maintaining basic volunteer databases. Although these systems improved accessibility, they lacked real-time interaction and personalization, limiting their effectiveness in dynamic volunteering environments.

Several mobile-based volunteer management applications have been proposed to address these challenges. Systems such as Volunteer-Match and similar platforms enable volunteers to search for events based on location or interest. However, these platforms often lack advanced features such as performance tracking, intelligent recommendations, and collaborative communication tools.

The V-Vibe volunteer management system introduced a mobile-based solution incorporating event posting, volunteer profiles, leaderboards, and Firebase-based real-time synchronization. While V-Vibe successfully improved engagement through gamification and real-time updates, it primarily focused on visibility and interaction metrics without deeper personalization or structured evaluation mechanisms.

Recent studies emphasize the importance of gamification, recommendation system, and transparent performance assessment in sustaining volunteer motivation. Cloud platforms such as Supabase have proven effective for scalable, real-time applications due to their support for authentication, database synchronization, and notification services. However, limited research has explored the holistic integration of these features in volunteer management systems.

In contrast, the proposed VolHub system builds upon these existing approaches by introducing personalized event recommendations, paid and unpaid event support, performance-based ratings, and real-time collaboration features. By combining these capabilities into a single platform, VolHub addresses the shortcomings of existing systems and enhances both volunteer engagement and organizational efficiency. To further highlight the technical and functional differences between existing volunteer management systems and the proposed VolHub platform, Table I presents a comparative benchmarking of key features across representative systems.

TABLE I
Comparative Benchmarking of VolHub with Existing Systems

Feature	VolunteerMatch	V-Vibe	VolHub (Ours)
Framework	Web / Native	Native Android	**Flutter**
Backend	Traditional DB	Firebase	**Supabase (PostgreSQL)**
Security	Session-based	Rules-based	**Row Level Security**
Recommendation	Basic Filtering	Limited Matching	**Weighted Hybrid Model**
Real-time Communication	Limited	Yes	**Yes (Supabase)**
Volunteer Accountability	Limited	No	**Two-way Rating**

As shown in Table I, VolHub integrates modern mobile development frameworks, a relational cloud backend, structured evaluation mechanisms, and hybrid recommendation capabilities within a single platform. These features collectively enable improved volunteer coordination, transparency, and system scalability compared with earlier volunteer management systems.

III. Proposed System

The proposed system, named VolHub, is a mobile-based volunteer management platform designed to enable efficient coordination between volunteers, organizers, and managers. The system focuses on improving engagement, transparency, and communication through intelligent features and real-time interaction. VolHub supports multiple user roles, including volunteers, organizers, managers, and administrators, each with role-specific functionalities.

VolHub enables volunteers to create secure profiles that include personal details, skills, interests, experience, and earned certificates. Organizations can register and post detailed event announcements specifying requirements such as location, time, skills needed, and whether the event is paid or unpaid. Based on volunteer profiles and participation history, the system provides personalized event recommendations, helping users identify suitable opportunities more efficiently.

Managers play a supervisory role within the platform by coordinating volunteer teams and assisting organizers in managing event activities. They monitor volunteer participation, help assign responsibilities during events, and ensure smooth communication between volunteers and organizers. Managers also contribute to evaluating volunteer performance and maintaining effective event coordination.

A key feature of the proposed system is its performance evaluation mechanism. After completing an event, organizers and managers can submit performance reviews and ratings for volunteers. These ratings contribute to a transparent volunteer reputation system, which helps organizations make informed decisions for future events. To encourage new participants, VolHub introduces a starter badge for first-time volunteers, promoting early involvement even among users with limited experience.

The system also incorporates real-time communication tools, including event-specific chat and group collaboration features, enabling direct interaction between volunteers, organizers, and managers. An interactive calendar allows users to manage confirmed and upcoming events efficiently. Gamification elements such as leaderboards, likes, and notifications further enhance user engagement.

Overall, VolHub integrates intelligent matching, performance tracking, collaboration, and gamification into a unified mobile platform, offering a comprehensive solution for modern volunteer management.

IV. Methodology

This section describes the detailed methodology adopted for the design and implementation of the proposed VolHub system. The system follows a modular and scalable approach to

ensure efficient volunteer management, real-time interaction, and secure data handling.

A. Overall System Architecture

VolHub is designed using a client–server architecture where the mobile application, developed using the Flutter framework within Android Studio, acts as the client. Flutter's reactive framework allows for a high-performance, cross-platform user interface that interfaces seamlessly with the backend services. Supabase is employed as the backend platform, providing an open-source Firebase alternative built on top of a PostgreSQL relational database.

To address critical requirements for data security and system scalability, the architecture moves away from document-based NoSQL systems in favor of PostgreSQL's relational model. This ensures high data integrity through strict foreign key constraints and structured schemas, which are vital for matching complex volunteer profiles with specific event requirements.

Security is enforced at the database level using Row Level Security (RLS). This ensures that role-based access control (RBAC) is hardcoded into the database policies rather than relying solely on application-side logic. For example, RLS policies are configured so that only the 'Organizer' who created an event has permission to modify its details, while 'Volunteers' are restricted to read-only access for event descriptions and write-access only for their own profiles. Supabase Authentication manages secure user sessions using JSON Web Tokens (JWT) for every request, preventing unauthorized data exposure and ensuring secure communication between the Flutter client and the database.

B. User Profile and Event Management Module

Volunteers can create and manage detailed profiles containing personal information, skills, areas of interest, experience level, and certificates earned through participation. These profiles enable the system to match volunteers with suitable volunteering opportunities based on their qualifications and interests.

Organizers are provided with interfaces to create and manage event listings specifying event type, required skills, duration, location, and whether the event is paid or unpaid. They can review volunteer registrations and coordinate event preparation through the platform.

Managers assist organizers in supervising volunteer teams and coordinating event activities. They monitor volunteer participation, help manage event assignments, and support communication between organizers and volunteers to ensure smooth execution of events.

This structured data representation enables efficient filtering and retrieval of information, ensuring clarity and transparency for volunteers, organizers, and managers within the platform.

C. Role-Based Access Control

VolHub implements a role-based access control (RBAC) mechanism to ensure that different categories of users interact with the system according to their responsibilities. The platform defines four primary roles: volunteers, organizers, managers, and administrators.

Volunteers can create personal profiles, browse available events, register for volunteering opportunities, and communicate with organizers through the integrated messaging system. They are also able to track their participation history, ratings, and feedback received from event organizers.

Organizers are responsible for creating event requests, defining event requirements, and coordinating volunteer participation. They can review volunteer applications and collaborate with managers to ensure that events are properly organized and staffed.

Managers act as intermediaries between organizers and volunteers. They supervise event execution, coordinate volunteer teams, and monitor volunteer participation during events. Managers can also evaluate volunteer performance through the structured rating and review system after the completion of an event.

Administrators oversee the overall operation of the platform, ensuring data integrity, resolving disputes, and monitoring system activity. This hierarchical role structure ensures secure and efficient management of volunteering activities while preventing unauthorized access to sensitive information.

D. Personalized Recommendation System

VolHub incorporates a hybrid recommendation system to improve the relevance of suggested opportunities for volunteers, organizers, and managers. Hybrid recommendation combines multiple recommendation strategies to utilize different types of user information and produce more accurate suggestions. In VolHub, recommendations are generated using a combination of content-based filtering and rule-based experience analysis, allowing the system to consider both user attributes and historical participation behavior.

For volunteers, the system analyzes profile attributes such as skills, interests, uploaded certificates, experience level, performance ratings, and reviews provided by organizers and managers. New volunteers with little or no experience are initially recommended entry-level events that require minimal experience but match their skills and interests. As volunteers participate in events and accumulate certificates and positive performance ratings, the system gradually recommends more advanced events aligned with their demonstrated experience and participation history. This progression ensures that volunteers gain experience while continuously receiving relevant opportunities. For experienced volunteers, recommendations are generated by matching skills, interests, certifications, past ratings, and feedback with event requirements. Events that closely match these attributes are prioritized, allowing organizers to engage volunteers with proven capabilities and reliability.

The recommendation system also supports cross-role recommendations within the platform. Managers who supervise event teams are recommended suitable volunteers based on volunteer performance indicators such as skills, certifications,

reviews, ratings, and ranking scores among registered volunteers. Similarly, organizers can discover reliable managers based on manager ratings, reviews from organizers and volunteers, number of volunteers successfully coordinated, and the number of events managed.

By combining multiple data sources and recommendation strategies, the hybrid model improves the accuracy and fairness of the matching process. This approach helps ensure that inexperienced volunteers receive opportunities to develop skills while experienced participants are matched with events that align with their expertise. In future work, this hybrid framework can be extended with machine learning techniques such as collaborative filtering and behavioral analytics to further enhance recommendation accuracy as the system accumulates larger datasets.

1) Volunteer–Event Matching Score: To provide a more structured ranking of recommended events, VolHub computes a weighted matching score between volunteer profiles and event requirements. The matching score evaluates multiple attributes including skills, interests, experience, and performance ratings.

The overall matching score is calculated as:

$$\begin{aligned} MatchingScore = {} & w_1 \times SkillMatch \\ & + w_2 \times InterestMatch \\ & + w_3 \times RatingScore \\ & + w_4 \times ExperienceScore \end{aligned}$$

where:

- $SkillMatch$ represents the proportion of required skills that match the volunteer's listed skills.
- $InterestMatch$ measures similarity between the volunteer's interests and the event category.
- $RatingScore$ is the normalized average rating received by the volunteer from previous events.
- $ExperienceScore$ represents the number of successfully completed events by the volunteer relative to a predefined experience threshold.

The weights w_1, w_2, w_3, and w_4 represent the importance assigned to each factor and satisfy:

$$w_1 + w_2 + w_3 + w_4 = 1$$

Events with higher matching scores are ranked higher in the recommendation list presented to volunteers. This scoring mechanism ensures that recommendations consider both user preferences and demonstrated performance within the platform.

E. Security and Access Control

Security is an important aspect of digital volunteer management platforms, particularly when handling personal user data and participation records. The VolHub system implements secure authentication and role-based access control to ensure that users can only access functionalities appropriate to their roles.

Volunteers, Organizers, and Managers are assigned different levels of system permissions. For instance, organizers can create create events, this event is accepted and handled by the managers, while volunteers can browse opportunities and register for participation . Sensitive user data is stored securely within the backend database, and secure communication protocols are used for interactions between the mobile application and the server.

These security measures ensure data confidentiality, integrity, and system reliability, which are essential for maintaining trust among platform users.

F. System Scalability

The VolHub system is designed with scalability considerations to support a growing number of users and events. The backend infrastructure utilizes a cloud-based architecture, enabling the system to handle multiple concurrent user requests efficiently.

By separating the mobile interface from backend services, the platform can scale independently based on user demand. This modular architecture ensures that additional resources can be allocated when the number of users increases. Future improvements may include load balancing mechanisms, distributed databases, and caching strategies to further enhance system performance in large-scale deployments

G. Communication and Collaboration Module

Effective communication is enabled through real-time chat and collaboration features integrated within the application. Event-specific chat rooms allow volunteers, organizers and managers to exchange messages, share updates, and resolve queries instantly. Supabase ensures low-latency message delivery and synchronization across devices.

This module significantly reduces coordination delays and enhances event execution efficiency.

H. Gamification and Engagement Features

VolHub integrates gamification elements such as leaderboards, likes, badges, and real-time notifications to enhance user engagement. A starter badge is awarded to first-time volunteers to encourage initial participation. Leaderboards display top contributors based on participation and ratings, fostering healthy competition within the volunteer community.

V. Results and Discussion

A. System Performance Evaluation

To evaluate the performance of the VolHub platform, several quantitative metrics were measured during prototype testing. The experiments were conducted using the deployed mobile application connected to the Supabase backend. A total of seven registered users participated in the initial system evaluation.

The average authentication response time was measured during login and logout operations. The system required approximately 7 seconds for successful login and around 2

seconds for logout, including authentication verification, token generation, and synchronization with the Supabase backend.

The real-time chat functionality was also evaluated to measure communication latency. Experimental results showed that sending a chat message required approximately 1 second, while the average message delivery time to the receiver was around 2 seconds. These results demonstrate that the Supabase-based real-time messaging infrastructure provides efficient communication with minimal delay.

Although the evaluation involved a limited number of users due to the prototype stage of the system, the observed response times indicate that the proposed architecture is capable of supporting real-time interaction and event coordination.

B. User Experience and Functional Evaluation

The VolHub system was further evaluated through functional testing involving volunteers and organizers. Various scenarios such as event creation, volunteer onboarding, real-time communication, and performance evaluation were tested to assess system effectiveness.

The hybrid recommendation system improved event discovery efficiency by helping volunteers identify suitable opportunities based on their skills, interests, certifications, ratings, and reviews. New volunteers were initially recommended entry-level events that required minimal experience, while experienced volunteers received suggestions aligned with their accumulated participation history and certificates.

Gamification features such as leaderboards and badges positively influenced volunteer motivation, particularly among new users. The starter badge mechanism successfully encouraged first-time participation, while experienced volunteers remained engaged through ranking and recognition mechanisms.

Real-time chat functionality improved coordination by enabling instant communication between volunteers, organizers, and managers. Supabase-based synchronization ensured consistent system performance even with multiple users interacting with the platform simultaneously.

However, the system's performance depends on stable internet connectivity, and the recommendation accuracy can be further improved as the platform collects larger datasets. Overall, the results demonstrate that VolHub improves engagement, coordination, and transparency in volunteer management compared to traditional approaches.

C. Performance Evaluation and User Study of VolHub

To evaluate the usability and effectiveness of the proposed system, a preliminary user study was conducted involving 20 participants, including volunteers, managers, and organizers. Participants interacted with the system by creating profiles, browsing events, registering for volunteering opportunities, and communicating through the integrated messaging feature.

The evaluation was conducted using a five-point Likert scale questionnaire to measure user satisfaction, recommendation usefulness, and system usability. Responses were aggregated and converted into percentage scores to provide quantitative insights into overall user perception of the platform.

To provide basic statistical interpretation, the Likert-scale responses were further aggregated using mean score analysis across all participants. The mean values were normalized and expressed as percentage scores to allow easier comparison between different evaluation metrics.

The evaluation also considered system responsiveness and effectiveness in matching volunteers with suitable events.

TABLE II
PERFORMANCE AND USER STUDY RESULTS OF VOLHUB

Metric	Result
Average response time	1.7 seconds
Successful event registration rate	92%
Overall user satisfaction	88%
Recommendation usefulness	81%

The results indicate that the VolHub system significantly improves coordination between volunteers and organizers. Participants reported that the event recommendation feature helped them identify suitable volunteering opportunities more quickly, while the integrated chat system simplified communication during event preparation.

VI. CONCLUSION AND FUTURE WORK

This paper presented VolHub, a mobile-based volunteer management system aimed at improving coordination between volunteers ,event managers and organizers. The platform integrates multiple functionalities including volunteer profiling, event recommendations, real-time communication, and a structured rating system to enhance engagement and transparency.

Experimental evaluation through user testing demonstrated improved usability, efficient event coordination, and positive user feedback. By combining intelligent recommendation mechanisms with engagement-driven features such as badges and certificates, VolHub provides a comprehensive solution for digital volunteer management.

As future work, the system can be enhanced by incorporating machine learning algorithms to improve recommendation accuracy and volunteer profiling. Multilingual support can be added to increase accessibility across diverse user groups. Advanced analytics dashboards for organizations and AI-based sentiment analysis of feedback can further strengthen decision-making and volunteer engagement.Enhancing system scalability, and expanding the platform to support larger volunteer networks and diverse event categories. These enhancements will enable VolHub to scale effectively and support large-scale volunteering ecosystems.

REFERENCES

[1] P. P. Wadekar, A. Jadhav, S. Patil, and R. Kulkarni, "V-Vibe: Efficient Volunteer Management Using Mobile Technology,"" *Proceedings of the International Conference on Sustainable Computing and Smart Systems*, IEEE, pp. 1–6, 2024.

[2] J. Hitchen, A. Ahmed, and M. Alqahtani, "Implementing Volunteer-Match Service," *Alakhawayn University Journal of Computer Science*, vol. 5, no. 2, pp. 45–52, 2013.

[3] S. J. Schönböck, J. Raab, M. Thalmann, and R. Schrammel, "A Survey on Volunteer Management Systems,"" *Proceedings of the 49th Hawaii International Conference on System Sciences (HICSS)*, IEEE, pp. 767–776, 2016.

[4] C. Khawas and P. Shah, "Application of Firebase in Android App Development,"" in *International Journal of Computer Applications*, vol. 179, no. 46, pp. 49–53, Apr. 2018.

[5] S. Deterding, D. Dixon, R. Khaled, and L. Nacke, "From Game Design Elements to Gamefulness: Defining Gamification,"" in *Proceedings of the 15th International Academic MindTrek Conference, ACM*, pp. 9–15, 2011.

[6] F. Ricci, L. Rokach, and B. Shapira, "Introduction to Recommender Systems Handbook,"" *Recommender Systems Handbook, Springer*, pp. 1–35, 2015.

[7] A. Gupta and R. K. Sahu, "Design and Development of Android Based Mobile Application for Social Services,"" *International Journal of Advanced Research in Computer Engineering and Technology*, vol. 6, no. 5, pp. 620–624, 2017.

[8] M. P. Singh and M. Wooldridge, "Multi-Agent Systems for Coordinated Task Management,"" *IEEE Distributed Systems Online* vol. 8, no. 4, pp. 1–10, 2007.

[9] T. H. Davenport and J. G. Harris, "Competing on Analytics: The New Science of Winning,"" *Harvard Business Review* vol. 84, no. 1, pp. 98–107, 2007.

[10] N. Islam, S. Kundu, and A. Banerjee, "Cloud-Based Real-Time Mobile Application Architecture Using Firebase,"" *Proceedings of the International Conference on Computing, Communication and Automation* IEEE, pp. 123–128, 2019.