International Journal of Engineering Research & Science (IJOER) ISSN: [2395-6992] [Vol-12, Issue-3, March 2026]

Role-Oriented User Interaction Model for Smart Residential Society Management Systems

Pratik Parsewar[1*]; Janhavi Ovalkar[2]; Bhavik Patil[3]; Sahil Singh[4]

Department of EXTC, VIVA Institute of Technology / University of Mumbai, India
*Corresponding Author

Abstract— *Rapid urbanization and the continuous expansion of residential communities have made traditional society management methods inefficient and difficult to maintain. Manual record keeping, offline notices, and cash-based transactions often lead to delays, errors, and lack of transparency in daily operations. To overcome these challenges, this paper presents an application-based Society Management System that automates major administrative activities such as resident and flat management, maintenance billing, complaint registration and tracking, visitor monitoring, and digital notice distribution. The system is developed using the MERN stack, which ensures fast performance, scalability, and reliable cloud-based data handling. Real-time communication features allow instant updates and emergency alerts to residents, improving coordination and response time within the community. Role-Based Access Control (RBAC) is implemented to provide secure and structured access for different users such as administrators, residents, and security personnel, thereby protecting sensitive data from unauthorized use. Secure authentication using JSON Web Tokens (JWT) and encrypted payment gateway integration further enhance data security and financial reliability. The proposed system reduces manual workload, improves transparency, and increases community participation by offering a centralized and user-friendly digital platform. Due to its modular and scalable architecture, the system can be easily adapted for societies of different sizes, making it suitable for modern smart residential communities and future smart city applications.*

***Keywords— Digital Governance, JWT Authentication, MERN Stack, Real-Time Communication, Role-Based Access Control (RBAC), Smart Communities, Society Management System*.**

I. INTRODUCTION

The rapid expansion of urban residential complexes has substantially increased the administrative and operational complexity of housing societies. Effective coordination among residents, management committees, and security personnel requires structured communication, transparent financial governance, and secure data handling mechanisms. Traditional administrative practices—such as manual record keeping, offline maintenance billing, and physical complaint registers—have consistently been reported as inefficient, error-prone, and lacking transparency [1], [2].

Early implementations of society management systems attempted to digitize these operations to improve workflow efficiency; however, many such solutions were limited in scalability and system integration, restricting their long-term sustainability in growing residential communities [1]. The evolution toward cloud-enabled platforms significantly enhanced accessibility and centralized administrative control. Cloud-based housing management frameworks demonstrated improvements in data availability, coordination efficiency, and remote system access, thereby addressing several operational bottlenecks associated with localized systems [3].

With the advancement of intelligent technologies, modern society management platforms have begun incorporating automation and AI-assisted functionalities. The AI-driven "Society Sync" framework illustrated how digital transformation can improve operational transparency, streamline complaint handling, and enhance billing management within residential ecosystems [4]. Similarly, smart society management models emphasize automation, modular integration, and mobile accessibility as essential enablers of efficient governance [2].

Practical mobile-based implementations further validate the benefits of unified platforms integrating complaint tracking, billing, visitor monitoring, and communication services within a single application environment [5]. Beyond operational efficiency, the transition toward digitally managed residential communities aligns with broader smart urban development initiatives. Integrated smart community frameworks highlight the interconnection between residential management systems, citizen awareness, and sustainable infrastructure planning [6].

Security governance remains a foundational requirement in multi-user residential systems. The foundational Role-Based Access Control (RBAC) model formally structured permission assignment based on predefined roles, reducing unauthorized

access risks and improving accountability [8]. Subsequent research demonstrates RBAC's effectiveness in distributed and IoT-enabled environments, confirming its suitability for scalable and cloud-based infrastructures [9].

In addition to structured access control, robust communication security and data protection mechanisms are essential to safeguard sensitive personal and financial information. Established network security principles emphasize encrypted communication protocols, secure authentication mechanisms, and protected APIs as core safeguards in web-based systems [10]. Furthermore, modern mobile applications increasingly rely on cloud-hosted real-time databases to ensure scalability, synchronization, and high availability, as demonstrated in Firebase-based implementations [11].

Research Gap: Although substantial research addresses individual components—such as AI-enabled management [4], RBAC security models [8], cloud-based housing systems [3], and mobile database integration [11]—there remains limited work presenting a unified, end-to-end architectural framework specifically tailored to residential society management. Existing studies largely examine these elements in isolation, resulting in fragmented implementations rather than cohesive governance ecosystems. Therefore, there is a clear need for an integrated, scalable, and security-centric Society Management System that systematically combines administrative automation, advanced role-based authorization, cloud-enabled data synchronization, and real-time communication infrastructure.

II. LITERATURE SURVEY

2.1 Digital Society Community Management Systems

Research on digital society community management systems focuses on transforming traditional residential society operations into smart, automated platforms. Key features include resident data management, maintenance billing, complaint logging, group coordination, and digital communication. These studies support the concept of smarter communities (Society 5.0) where physical services are enhanced using cyber-technology. Digital platforms improve transparency, reduce administrative workload, and increase user satisfaction in residential environments [1], [2], [5].

2.2 Security Access Control in Digital Platforms

Research on Role-Based Access Control (RBAC) mechanisms focuses on managing permissions and preventing unauthorized access in commercial database systems [8], [9]. Assigning different roles (such as admin, user, manager, etc.) enhances data confidentiality and reduces internal security risks. This research is crucial for systems that handle sensitive information, ensuring that only authorized users can access specific functionalities and records.

2.3 User Interaction, Notification Behavior, and Secure Online Payments

Studies on user experience and secure financial communication address critical aspects of modern applications [10], [11]. Research on push notifications analyzes the impact of aggressive notifications on user comfort and privacy, providing insights into responsible communication strategies. Work on secure online payment gateways focuses on encryption techniques to ensure reliable digital financial transactions. Together, these studies address user trust, safety, and experience.

2.4 Research Gap Identification

Despite several research studies focused on smart society applications, group coordination platforms, secure payment gateways, and role-based access mechanisms, existing literature primarily addresses individual aspects of digital society administration rather than offering a holistic solution. Key gaps include:

- Lack of integration of core society management requirements (real-time communication, automated billing, structured complaint tracking, visitor authentication, digital notice circulation) within a single unified platform
- Limited attention to multi-level role customization and cloud-based scalability for large residential communities
- Absence of secure mobile-friendly interfaces usable by diverse age groups
- Lack of practical implementation strategies for RBAC in residential environments
- No end-to-end architecture capable of automating daily society operations while maintaining transparency and accountability

III. DESIGN METHODOLOGY

3.1 System Architecture

The proposed system architecture consists of a frontend built using React.js, React Native, and Next.js, which communicates with an API layer developed using Node.js and NestJS. Backend services handle authentication via Auth0 and payments through Razorpay. All data is stored and managed using Supabase with a PostgreSQL database, while deployment and version control are handled using Vercel and GitHub.

3.2 Role-Based Access Control

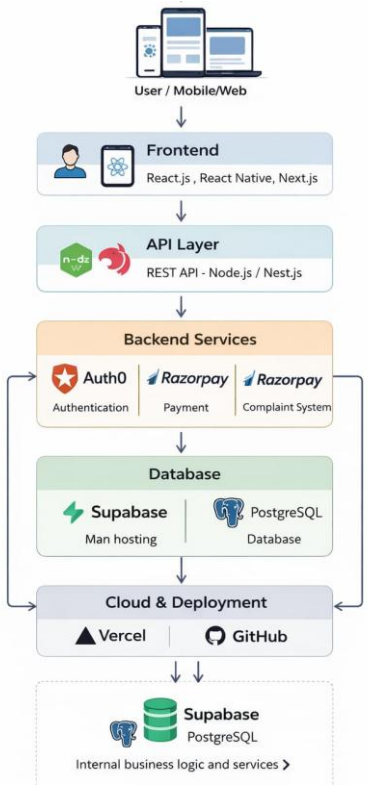

Figure 1: Role-Based Chart

The system implements the following user roles

3.3 System Flowchart

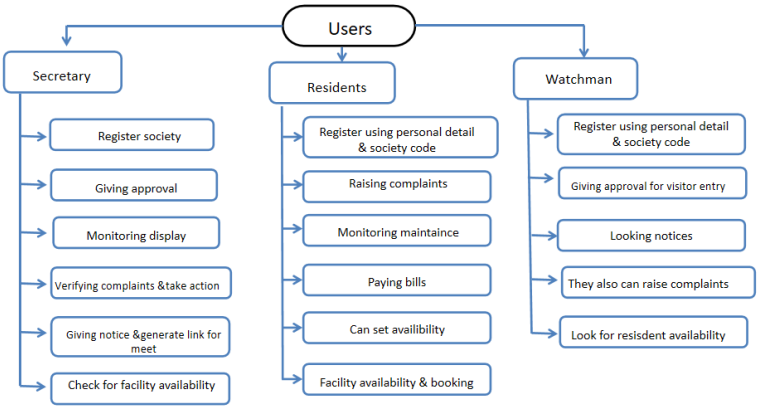

Figure 2: Flowchart of the Proposed System

International Journal of Engineering Research & Science (IJOER) ISSN: [2395-6992] [Vol-12, Issue-3, March 2026]

The system flow begins with user authentication, followed by role-based redirection to appropriate dashboards. Users can perform role-specific tasks such as bill payment, complaint registration, visitor management, and notice viewing. All actions are logged and synchronized with the cloud database in real time.

Role	Responsibilities
Secretary	Administration, approvals, complaints, notices, facility management
Residents	Registration, bill payments, complaints, facility bookings
Watchman	Visitor entry management, notices, availability checks
Treasurer	Financial management, billing oversight
Chairman	Overall governance and strategic decisions

IV. RESULTS AND DISCUSSION

4.1 Role Selection and Admin Dashboard

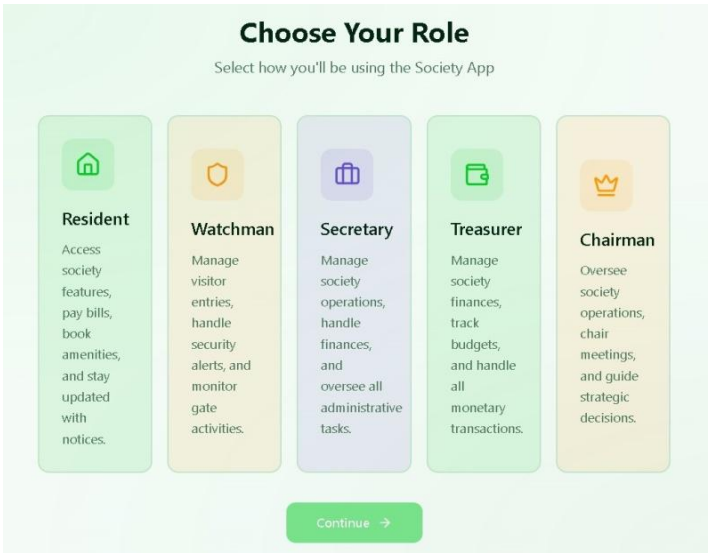

Figure 3: Role Selection Page

The role selection screen allows users to choose roles such as Resident, Watchman, Secretary, Treasurer, and Chairman, enabling role-based access control.

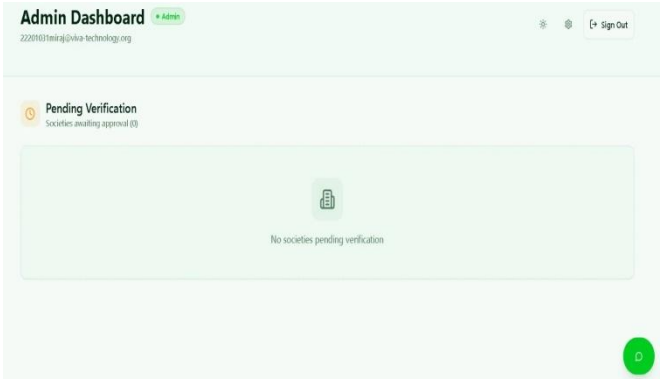

Figure 4: Admin Dashboard

The admin dashboard provides centralized control for monitoring and managing society verifications, ensuring efficient administrative operations.

4.2 Resident and Analytics Dashboards

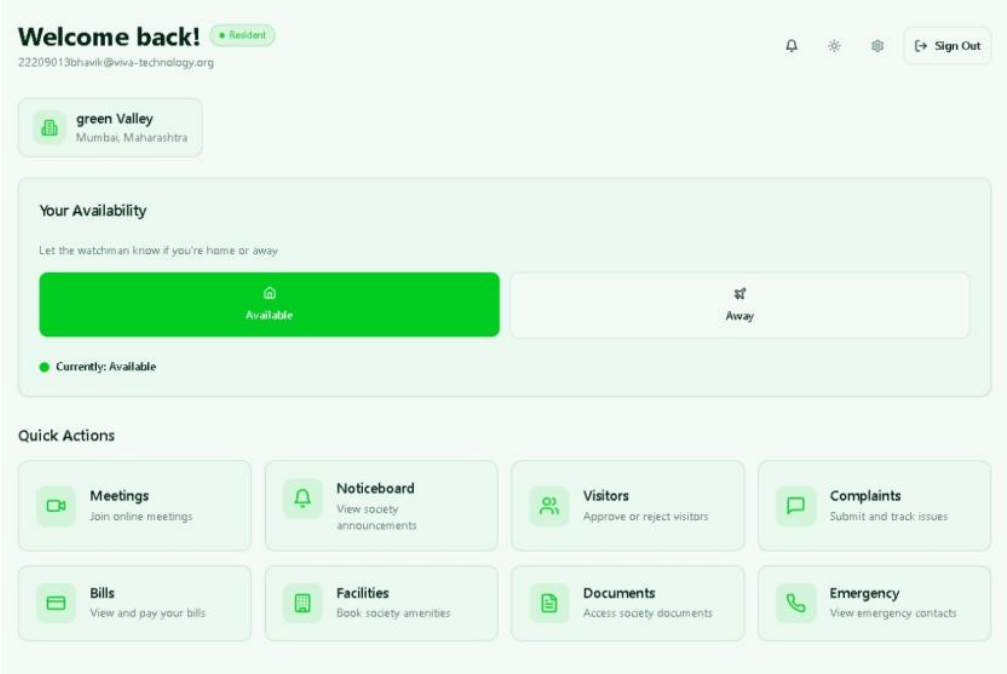

Figure 5: Resident Dashboard

The resident dashboard offers quick access to features like meetings, bills, visitors, complaints, and emergency services, ensuring efficient user interaction and accessibility.

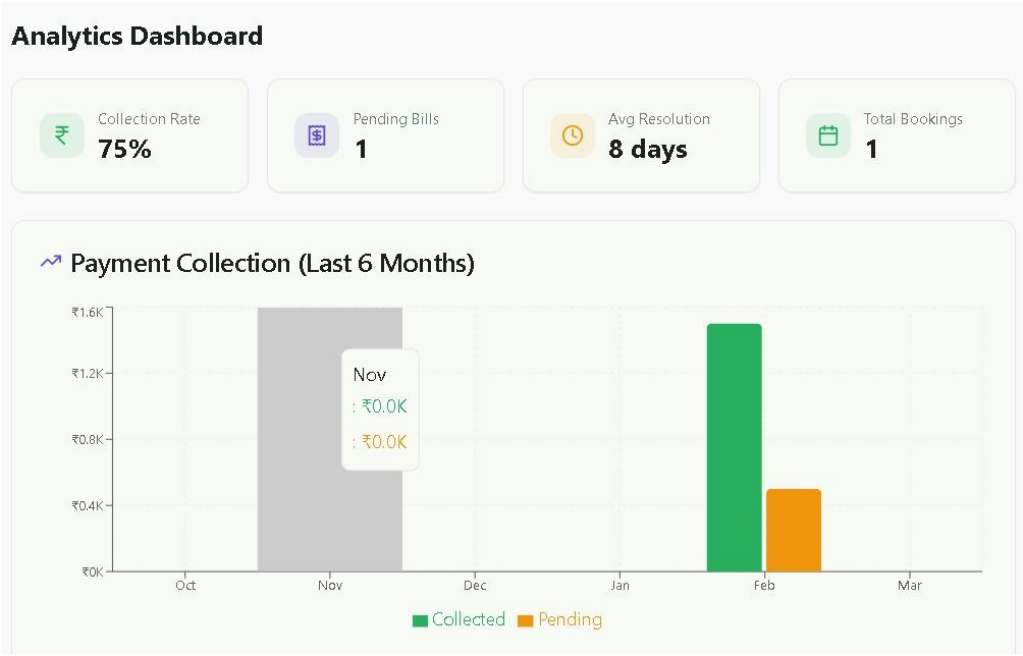

Figure 6: Analytics Dashboard

The analytics dashboard displays key metrics such as collection rate, pending bills, resolution time, and payment trends, providing insights into system performance.

4.3 Key Functionalities

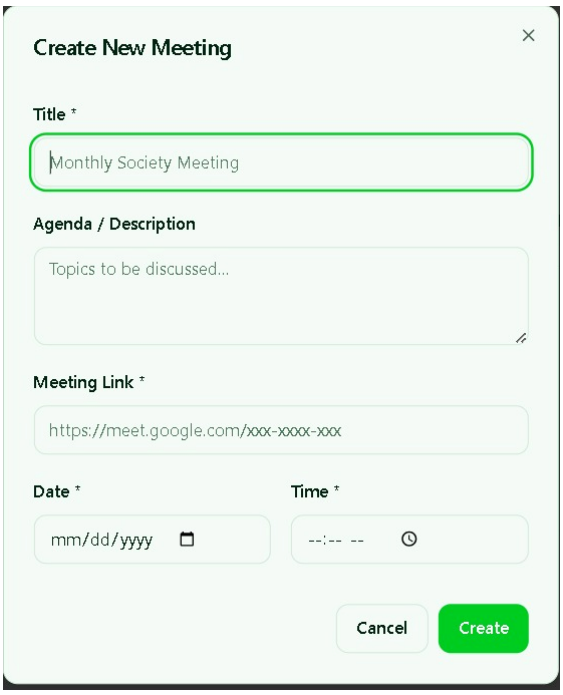

Figure 5: Online Meeting

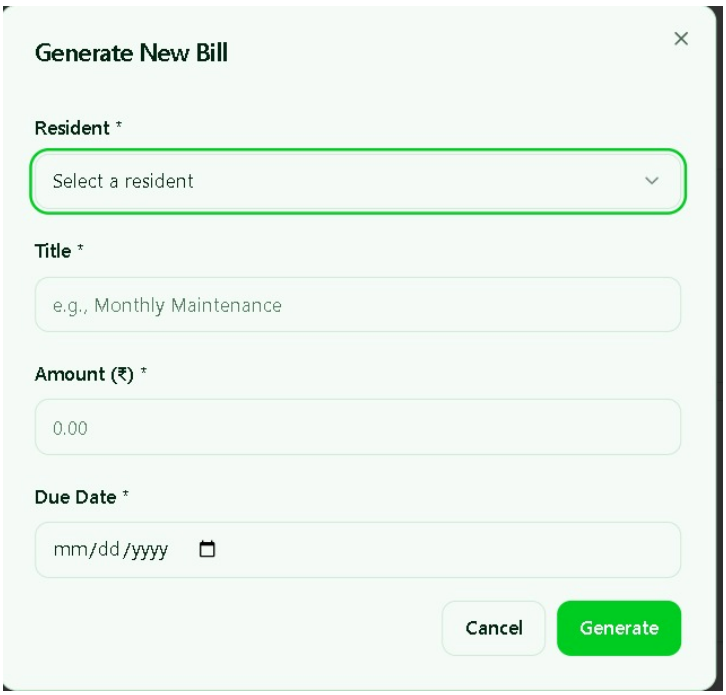

Figure 6: Bill Generation

4.4 Discussion

The experimental results demonstrate that the proposed solution improves efficiency, transparency, and resident satisfaction while reducing manual workload for management committees. The modular architecture allows easy scalability and feature expansion. Secure authentication and structured role permissions ensure data protection and system integrity.

V. CONCLUSION

This paper presented an application-based Society Management System that integrates real-time communication and Role-Based Access Control to automate residential society operations. The system effectively manages billing, complaints, visitor tracking, and communication through a centralized digital platform. Secure authentication and structured role permissions ensure data protection and system integrity.

Key Contributions:

1. Unified platform integrating core society management requirements
2. Role-Based Access Control for secure, structured user access
3. Real-time communication for instant updates and emergency alerts
4. MERN stack implementation for scalability and performance
5. JWT authentication and encrypted payment gateways for security

Future Work:

- Integration of Artificial Intelligence for complaint classification and predictive maintenance
- IoT-based smart gate systems for automated visitor management
- Mobile application deployment with offline support
- Biometric authentication for enhanced security

- Advanced analytics for decision support

These enhancements will further contribute to smart city infrastructure and digital governance of residential communities.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to the Department of EXTC, VIVA Institute of Technology, for providing the necessary facilities and support to carry out this research work.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

REFERENCES

[1] Thacker, M., Shah, L., & Shah, M. (2022). Society sync–digitalize society management systems with artificial intelligence technologies. *Intelligent Systems with Applications, 14*, Article 200069.

[2] Sandhu, R., Coyne, E., Feinstein, H., & Youman, C. (1996). Role-based access control models. *Computer, 29*(2), 38–47.

[3] Stallings, W. (2003). *Network security essentials: Applications and standards*. Pearson Education.

[4] Singh, J., Rani, S., & Kumar, V. (2024). Role-based access control (RBAC) enabled secure and efficient data processing framework for IoT networks. *International Journal of Communication Networks and Information Security, 16*(2), 91–103.

[5] Madaminov, U. A., & Allaberganova, M. R. (2023). Firebase database usage and application technology in modern mobile applications. In *2023 IEEE XVI International Scientific and Technical Conference Actual Problems of Electronic Instrument Engineering (APEIE)* (pp. 1690–1694).

[6] Vatharkar, R., Gaikwad, A., & Shinde, S. (2016). Implementation of society management system. *International Journal of Science and Technology*.

[7] Andhale, A., Mene, T., & Yeola, H. (2021). Smart society management system. *Journal of Science & Technology, 6*(Special Issue 1), 196–205.

[8] Vengurlekar, S., Bhalerao, P., & Sankhe, N. (2022). Housing society management. *IJRASET: Journal for Research in Applied Science and Engineering Technology*.

[9] Shah, T. (2018). Cloud-based housing society management system. *International Journal of Computer Applications, 179*(47), 35–41.

[10] Bing, G., & Karim, A. M. (2024). Study on society awareness and smart city and facilities management: Integrated approach. *International Journal of Academic Research in Business and Social Sciences, 14*(1), 265–478.

[11] Akpınar, M. T., & Atak, M. (2025). An integrated technology acceptance model for smart city mobile applications: Identification of key factors and extension of technology adoption. *International Journal of Management Studies, 32*(1), 109–131.

[12] Gavai, B., Rokade, S., Gupta, S., & Chaudhari, R. (2023). Smart Android app for society security and management. *IJSRD, 11*(3).