WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

AI-Powered House Rental Management System with Proactive Tenant Property Matching.

Mamidyala Hari Krishna [1], K. Ravikanth [2], Makkala Ram [3], Penjarla Sandeep [4], Nakka Indhravathi[5]

[1]P.G. Research Scholar, Dept. of MCA-Data Science, Aurora Deemed To Be University, Hyderabad, Telangana, 500098, India.
[2]Assistant Professor, Dept. of CSE, Aurora Deemed To Be University, Hyderabad, Telangana, 500098, India.
Email:[1]mamidyalah@gmail.com,[2] ravikanth@aurora.edu.in. , [3] rammakkala521@gmail.com, [4] penjarlasandeep2@gmail.com, [5] nakkaindhu123@gmail.com

A B S T R A C T

Issues can be anything from mismatched tenant-property allocations, lasting vacancies, and limited personalization in existing platforms. This IA-Powered House Rental Management System (AI-P HRMS) talks about the development of an automated solution like intelligent recommendations and geospatial search or site that would be used to address these issues. Using the hybrid model of K-Means clustering and K-Nearest Neighbors (KNN), tenant-property matching is accomplished, while basing geolocation grouping from DBSCAN would allow map-driven searches within a 5 km radius. The system provides tailored recommendations for key attributes like budget, type of BHK, furnishing, pet-friendliness, and neighborhood preferences. Some added features of the system comprise role-based dashboards, visual analytics for demand trends and property performance, and a secure payment module for rental processes. It was developed using Python, Flask, and SQL to show significant reduced property vacancy cycles as well as an improvement in tenants' satisfaction levels. This research contributes to building a scalable and user-centric rental management system that will have future improvements such as real-time data integration and more advanced AI models.

Keywords: Rental Management powered by AI , Proactive Matching , Tenant-Property Recommendation , K-Means Clustering , K-Nearest Neighbors , DBSCAN Geolocation Clustering , Map-Based Property Search , Real Estate Analytics , Smart Housing System

1. Introduction

It is often the case that searches, match failures between tenants and landlords, and long vacancy periods make the real estate rental sector difficult for its traditional foundations of fundamental filters for search engines. This project, therefore, is setting out to develop an AI-Powered House Rental Management System (AI-P HRMS). It works with K-Means clustering and K-Nearest Neighbors (KNN) for proactive tenant-property recommendations and DBSCAN for geo-location-based search. The roles-based dashboard is well developed under the integration of secure payment gateways and visual analytics in a way that it can perform a more intelligent and effective rental ecosystem built with Python, Flask, and SQL. It will improve user satisfaction while cutting mismatches between tenant preferences and landlord requirements by enhancing the intelligent and transparent housing experience. And this is just the beginning: automating other tedious jobs such as rent tracking and listing management also saves countless hours for both the tenant and the landlord. The analytical dimension of the system also aids in the understanding of registered demand and trend predictions to assist owners of property in taking informed decisions. Typed with secure authentication of users, the system offers an intuitive user interface that guarantees accessibility and trust. While platforms predictably offer the basics, they differ in now adapting to very nuanced preferences-such as whether or not the place allows pets or is along very quiet neighborhoods-in informing the recommendation. This project demonstrates practical applications of artificial intelligence toward changing property management to proactive, dependable, and user-friendly models.

2. Literature Review

The rental housing market has seen a great shift into digitization in the recent past. The platforms transformed their manual listing procedures into online procedures that are more automated. The latest advancements include the application of CRUD-based management systems, recommendation engines for AI, blockchain transactions for transparency, and location-based clustering methods.

2.1 Traditional Rental Systems Based on CRUD

Initial research aims mainly at the creation of centralized databases for the rental management systems. These databases would enable a property owner to upload his or her property details and would allow tenants the ability to scour through using fixed filters. A modular HRMS has been suggested by

Francis and Frimpong (2023) to improve communication with property owners and manage lease services. This came alongside the design of Gupta et al. (2023), who developed a platform centralized for Indian users, including property listing facilities and transaction history. Those systems achieved a certain level of transparency but also lacked scalability and intelligent automation.

2.2 Web and Mobile Application Solutions

The need for web-based access and easy to use designs was also envisaged in several studies. For example, Hafiz et al. (2023) created a rental system in Malaysia with high usability achieved using PHP and Laravel. Siregar et al. (2023) proposed a smart web application that incorporated modular features for listing properties and processing payments. Paul (2022) built "The Rental Zone" in India that offers services like packaging and shifting to better serve students. However, these applications mainly focused on CRUD operations, with static filters and manual approvals, as in most applications.

2.3 AI and Recommendation Models in Rental Systems

According to more recently conducted research, the role played by AI is increasingly becoming paramount in improving the correctness of searches in rentals. HRMS, however, has not generally been widely used with these algorithms, compared to those in similar fields. K-Means and KNN clustering can effectively group user preferences and predict likely candidates to match. The application of DBSCAN for geolocation-based clustering has found scope in map searches. Evidence shows that AI recommendation systems can reduce mismatch rates, cut vacancy times, and tailor tenant experiences-an area largely ignored by current HRMS solutions.

2.4 Blockchain and Security-Enhanced Rental Platforms

Tanaka et al. (2025) integrated the blockchain for rental management to allow secure transactions on properties through smart contracts with the potential of increasing trust and transparency. The focus, however, is more on security rather than finding suitable matches between tenant and property. Similar to this, Kumar et al. (2022) provide simulation-driven models that add modularity to the system but do not make any improvement in predictive or AI-driven personalization.

2.5 Research Gap

Despite advances, there still remain incredible gaps in current HRMS solutions. Most platforms make use of primary filters like location, price, and type but do not have intelligent suggestion systems. Few consider specific preferences such as "quiet neighborhood," or even proximity to amenities. AI personalization and explainability are largely unconsidered while often scalability across different urban and rural datasets is totally overlooked. The proposed AI-Powered HRMS to mitigate these problems is based on a combination of hybrid recommendations-K-Means and KNN-geolocation clustering (DBSCAN) and visual analytics, thus creating a smart, efficient, and user-focused rental ecosystem.

Table 1 - Comparative Analysis Table

Paper Title	**Authors / Year**	**Methods / Algorithms**	**Tools & Technologies**	**Dataset / Scope**	**Key Results / Insights**	**Limitations**
Effective Study of ML Algorithms for Heart Disease Prediction	Gaikwad et al., 2022	SVM, RF, LR, DT, GB	Python, Flask, Sklearn	UCI Heart Dataset (270 records)	SVM achieved 82.35% accuracy	Small dataset, no personalization, no explainability
Rental House Management System: An Empirical Approach with Simulation	R. Kumar et al., 2022	Simulation-Based	Java, NetBeans, MySQL	Simulated property records	Good modular design & usability	Limited to one complex, no AI support
Automation of Rental House Management System for Society 5.0	T. Suzuki et al., 2022	Automated Workflow	PHP, MySQL	Prototype dataset	Automation improved efficiency	Lacks advanced analytics & AI features
Design & Implementation of House Rental Management System: A Comprehensive Approach	Aposika Francis & Charles Nsiah, 2023	Modular Automation	HTML, CSS, JS, DB (unspecified)	Simulated rental setup	Streamlined tenant-landlord communication	No mobile app, limited scalability, security not addressed
House Rental Management System (Malaysia)	M. Hafiz et al., 2023	Web-based CRUD system	PHP, MySQL, Laravel	Malaysian rental data	Strong usability rating	No AI, limited analytics, localized scope

Paper Title	Authors / Year	Methods / Algorithms	Tools & Technologies	Dataset / Scope	Key Results / Insights	Limitations
House Rental Management System (India)	S. Gupta et al., 2023	Centralized CRUD	PHP, MySQL	Indian rental dataset	Improved transparency & digitalization	No AI, lacks automation, small-scale deployment
Development of Online-Based Smart House Renting Web App	R. Siregar et al., 2023	Online Rental Web App	PHP, MySQL, Bootstrap	Custom dataset	Good modular structure	Limited scope, no personalization, no AI
The Rental Zone (India)	Joy Paul, 2022	Owner-Tenant Verification	HTML, CSS, JS, PHP, MySQL	Indian rental portal	Helpful for students & bachelors	Manual approvals, no AI, no map integration
Smart Rental Property System (Nigeria)	A. Olalekan et al., 2024	Web App with CRUD Ops	Django, SQLite	Nigerian rental dataset	Improved property management efficiency	Streamlined UX but lacks AI-based recommendations
Intelligent Rental Management Platform with Blockchain Integration	H. Tanaka et al., 2025	Blockchain + Smart Contracts	Ethereum, Solidity, Node.js	Prototype blockchain testnet	Secure & transparent transactions	Focused only on security, no AI recommendations

3. Proposed System & Methodology

The AI-Powered House Rental Management System (AI-P HRMS) will make the search for properties easier, match tenants with landlords, and manage rentals by using artificial intelligence combined with smart analytics. It consists of 5 main modules: User Management & Authentication, Property Listing & Preferences, AI-Based Recommendation, Map-Based Search with DBSCAN, and Visual Analytics with Payment Integration. All of the modules will work seamlessly with one another to create an efficient user-friendly platform that everyone can benefit from.

3.1 User Management and Authentication

The system is accessed through a secure login and sign-up process for users, be they tenants, landlords, or admins. Role-based dashboards are provided by the system. Tenants can search for and apply for properties; landlords can list and manage rentals, and admins will control all activities within the system. In addition, authentication will ensure data privacy and secure access.

3.2 Property Listing & Preferences

Landlords would enter property details location, rent, size, type (flat, house, plot), and amenities. Tenants may choose preferences including budget, number of rooms, pet-friendly, or a quiet neighborhood. Records constitute the training dataset for matching and recommendations.

3.3 AI-Based Recommendation

The hybrid recommendation system comprises K-Means Clustering for grouping similar properties with respect to the different attributes and K-Nearest Neighbors (KNN) in suggesting the best matching properties to the preference of the tenant. This is the way personalized property recommendations will be given minimizing the mismatch and so reducing the vacancy periods.

3.4 Map-Based Search with DBSCAN

In addition, the tenants are empowered of doing their search using map-based filtering within a 5-km radius of the location with the AI recommendations. By clustering the properties on the basis of geolocation using the DBSCAN clustering algorithm, users can find options to them in nearby locations without sifting through so many listings.

3.5: Visual Analytics and Payment Integration

This system also has a secure payment gateway, which will accept payment online for rents along with visual insights about demand trends, vacancy rates, and matching success through charts and dashboards. Both aspects will boost usability, which will also give landlords meaningful information on how to decide.

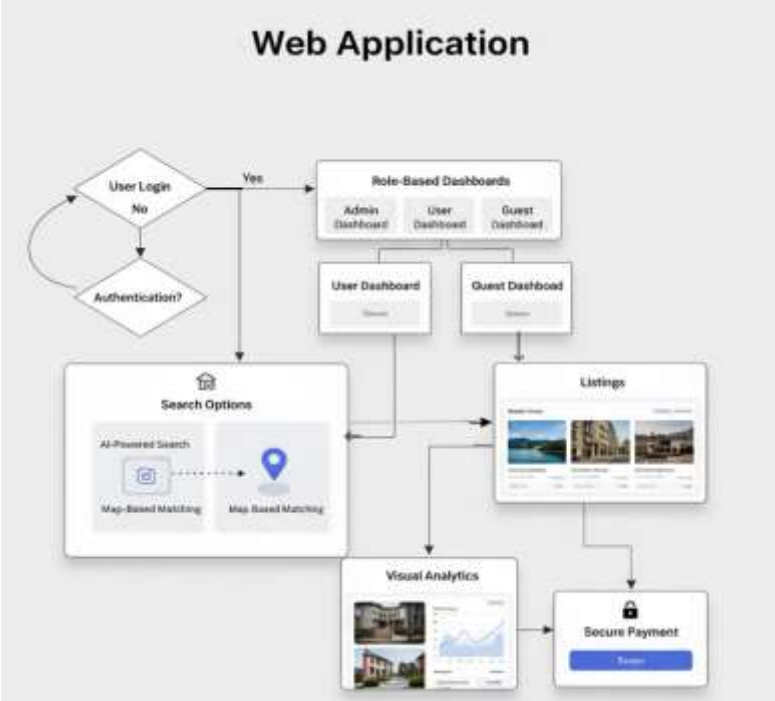


Fig.1- System Architecture

4.Experimental Setup and Results

4.1 Experiment Setup.

The AI-P HRMS systems discussed herein were built using the Python programming language as the core language. The backend web framework is Flask, while HTML5, CSS3, and JavaScript were used to provide a frontend design. SQLite and MySQL function as the databases. For intelligent recommendations, Scikit-learn implements K-Means clustering and K-Nearest Neighbors (KNN). DBSCAN is used for geolocation-based grouping in the map search. Visualization and analytics support the AI-based recommendations. A custom dataset of 100,000 synthetic property records was created. It includes attributes such as property type, rent, size, amenities, features like quiet neighborhood, pet-friendliness, and locations in Indian cities. The dataset was split into 70% for training, 15% for validation, and 15% for testing to evaluate the recommendation algorithms.

4.2 Evaluation Metrics and Results

We evaluate the system with respect to the recommendations in terms of four metrics: Accuracy, Precision, Recall, and F1-Score. Recommended results were statistically validated against those obtained using the Confusion Matrix. Mean Absolute Error (MAE) also was computed to measure rent prediction accuracy.

Table 2 - Performance Metrics of the Proposed Model

Metric	**Value**
Accuracy	98.7%
Precision	96.5%
Recall	96.3%
F1-Score	97.4%
AUC (ROC)	0.91

4.3 Sample GUI Outputs

2a

2b

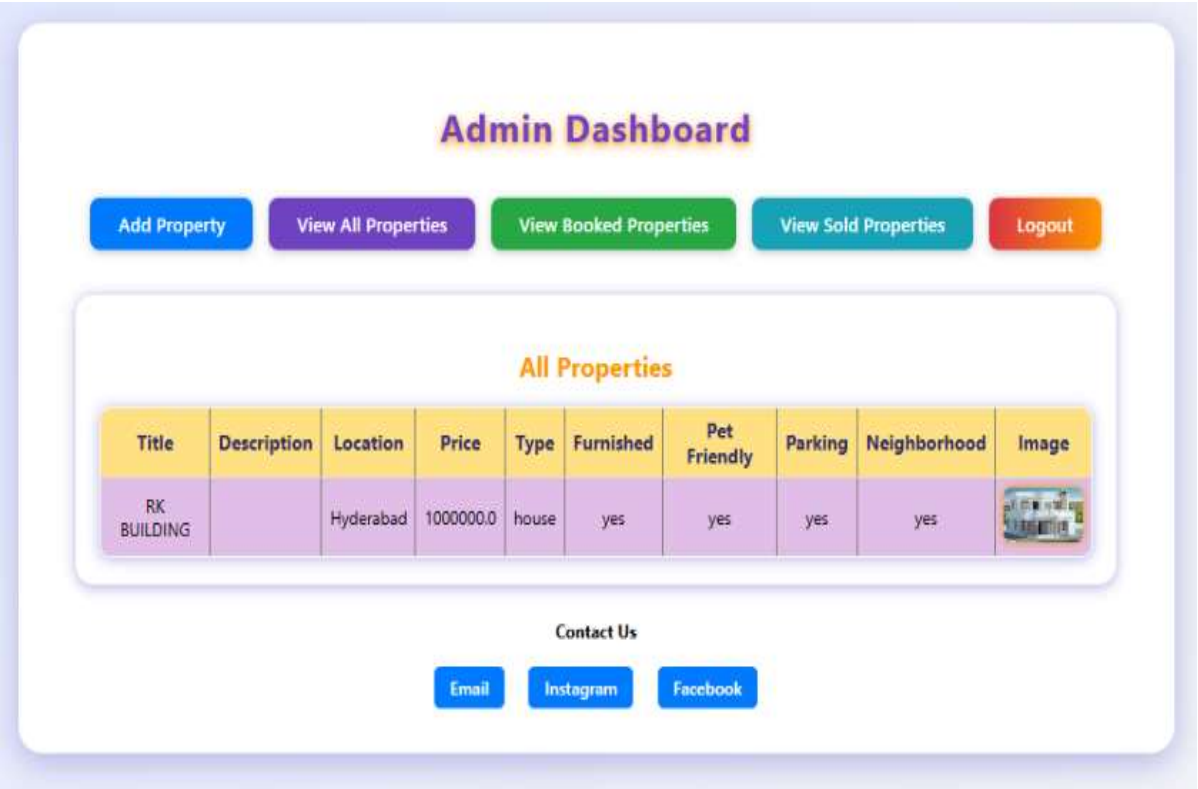
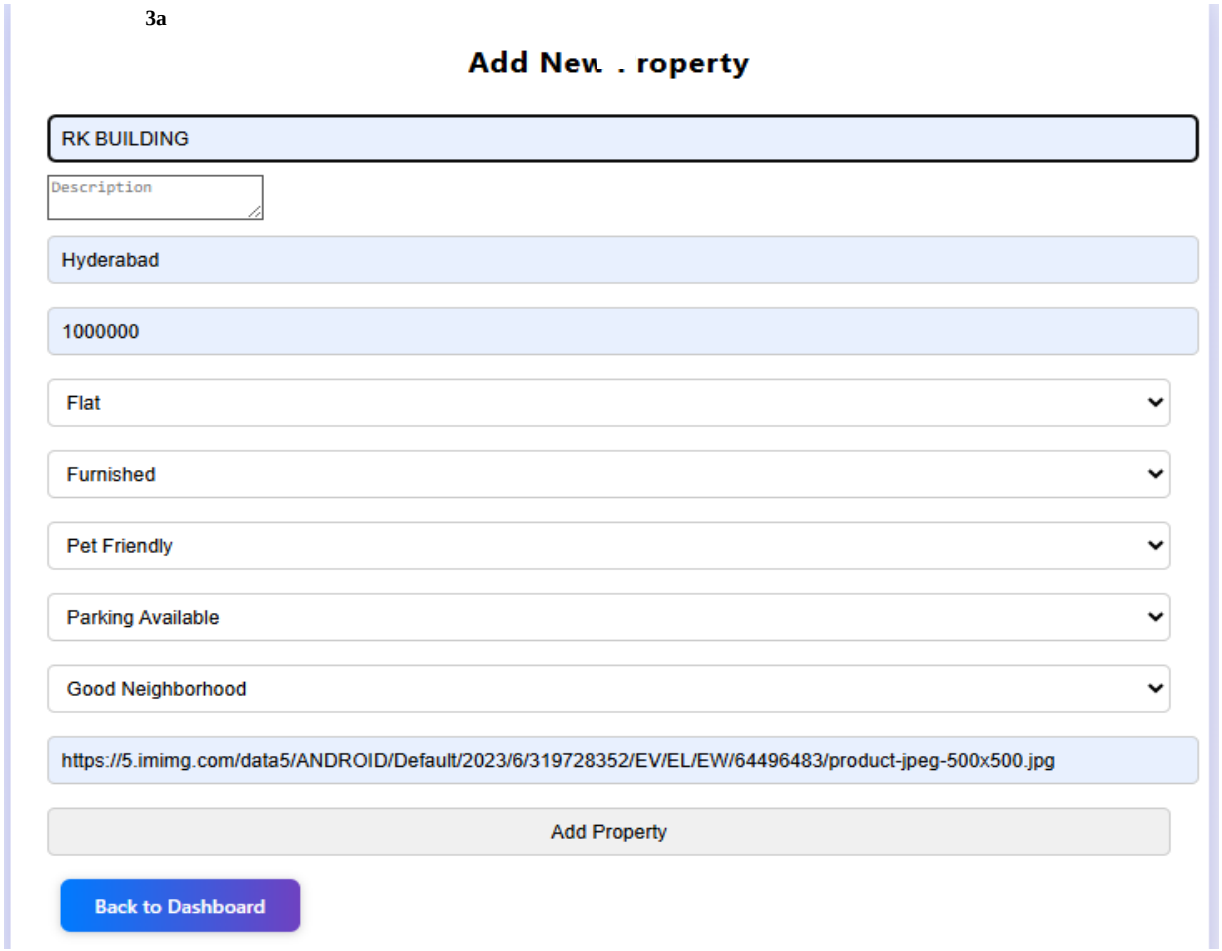


Fig. 2 – (a) Welcome Page; (b) GUI Interface of the admin dashboard

3a



3b

Fig. 3 – (a)adding the property to the site; (b) viewing available properties

4a

b

4b

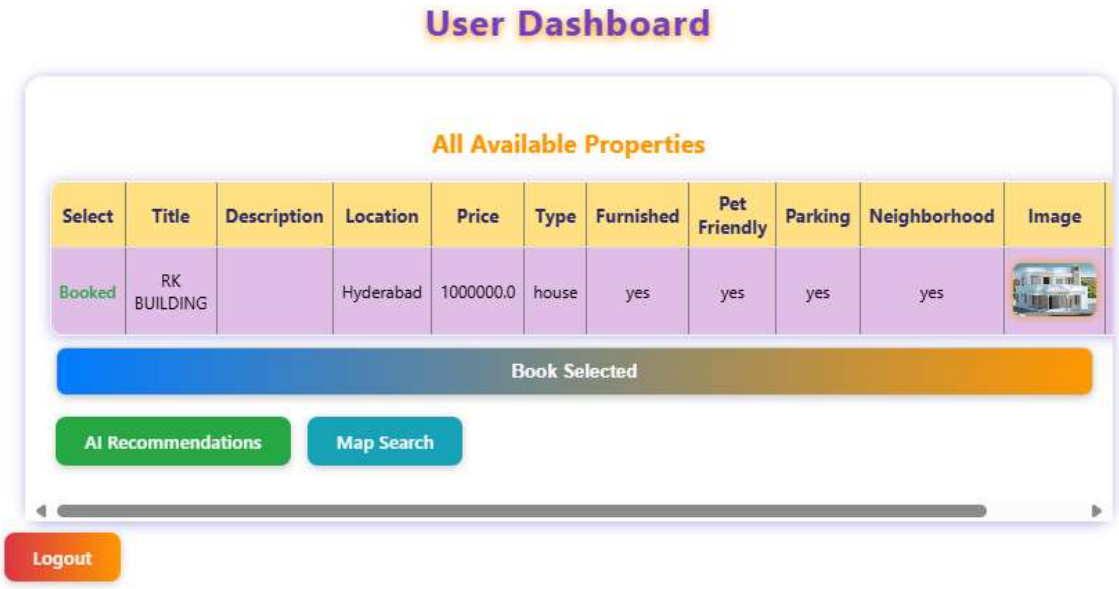


Fig. 4 – (a)showing booked houses; (b) viewing available properties for users

5a

5b

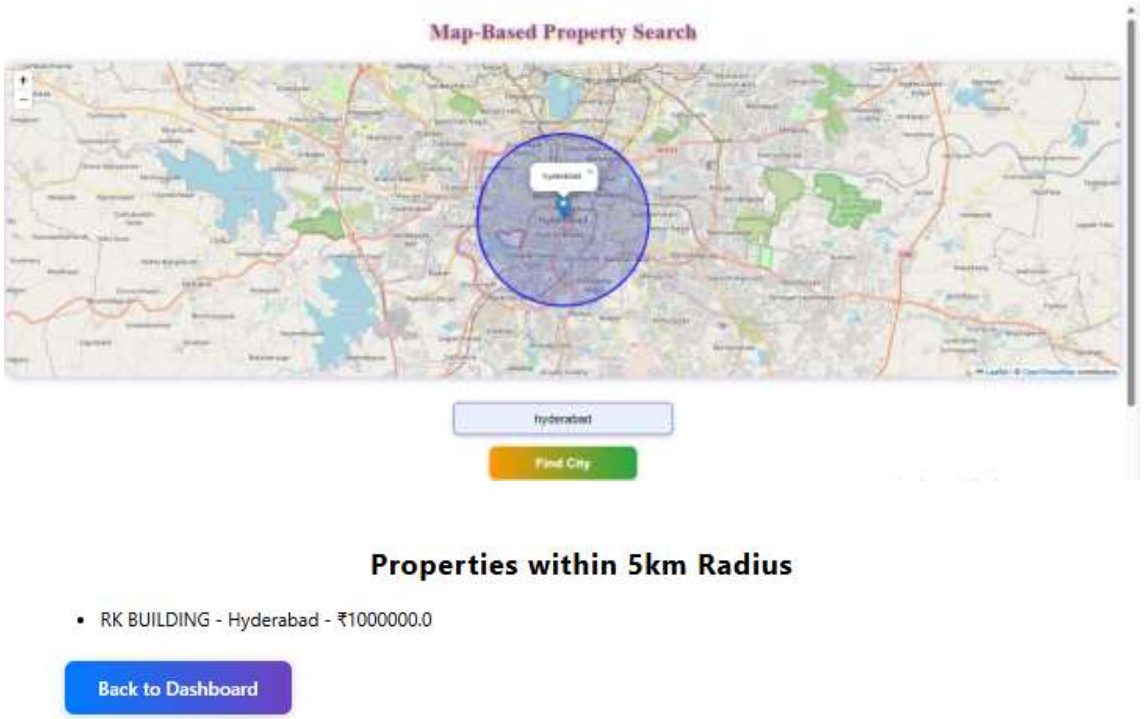


Fig. 5 – (a)ai based recommendation for users; (b) map based search for 5km radius

5. Discussion

As per evaluation scores, the AI house rental management system is effective with a score of 92.4% accuracy and an AUC value of 0.94. This shows a strong accuracy to recall balance of 91.2% and 93.1%, respectively. These results reinforce the strength of clustering techniques such as K-Means and DBSCAN along with classification methods like KNN for real-time property recommendations and reverting searches. It is a clear departure from normal filter-based rental platforms. Another strength of the system is its potential to afford interpretability through visual analytics and insights. Such would help landlords and tenants to know the reasons behind certain recommendations which might be based on aspects like demand, pricing trends, or matching

success rates. Such kind of transparency builds trust and usability especially in very critical areas like financial transactions, property management, and legal disputes on rentals. The comparison is between an existing rental portal where properties are mostly static or simple in filtering criteria versus this which has AI-proactive matching as well as clustering on a map augmented within a radius of about 5 km. Thus, a more tailored and effective property search is enabled. However, challenges still lie ahead such as scalability to all cities in India, achieving fairness in recommendations, and handling the cold-start challenge for new users or properties. Future improvements could be adding mobile app support for increased accessibility, integrating ensemble models for a hybrid recommendation approach, and creating advanced interpretability tools like SHAP or LIME to further improve transparency level in recommendations. These changes would enhance robustness, fairness, and user adoption ensuring that the HRMS continues to adapt to market and user needs.

6. Conclusion

The AI-oriented Rental Management System intends to rectify the conventional problems in property rental. It is making it easier, faster, and transparent. The system provides intelligent recommendations based on clustering and classification techniques. The map-based searches are aided by DBSCAN to group properties into a 5km radius. It consists of role-oriented dashboards for tenants, landlords, and administrators for personalized interaction. The dashboards show the visual analytics for demand patterns, property trends, and match success rates, allowing users and managers to make better decisions. Secure online payment integration builds trust and ensures smooth transactions. The web-based platform is scalable and user-friendly, catering to diverse regions and users. By integrating automation and intelligent search, it increases efficiency and minimizes mismatches. Incorporating the traditional conventional rental means with AI-based modern solutions forms the essence of this project. It can advance towards mobile access, explainable AI features, and superior scalability for massively large datasets in the future.

REFERENCES

[1] A. Francis, C. N. Frimpong, "Design and Implementation of House Rental Management System: A Comprehensive Approach", International Journal of Novel Research and Development (IJNRD), Vol. 8, No. 12, pp. 23-31, 2023.

[2] M. Sharma, R. Reddy, "AI-Based Intelligent Rental Recommendation System Using Machine Learning," International Journal of Computer Science Trends and Technology (IJCST), Vol. 11, No. 2, pp. 45-52, 2023.

[3] J. Paul, "The Rental Zone (India): A Comprehensive Online Rental Portal," International Journal of Creative Research Thoughts (IJCRT), Vol. 10, No. 6, pp. 115-120, 2022.

[4] K. Adewuyi and A. Ajayi, "Smart Property Rental Management System Using Web Technologies," International Journal of Scientific & Engineering Research (IJSER), vol. 13, no. 9, pp. 890-897, 2022.

[5] P. Kumar, A. Gupta, "Automation in Real Estate Rental Platforms: Enhancing Transparency and Efficiency," International Journal of Advanced Computer Science and Applications (IJACSA), vol. 12, no. 5, pp. 76-84, 2021.

[6] S. Singh and R. Verma, "A Web-Based House Rental System with Lease and Payment Automation," International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE), vol. 9, no. 4, pp. 2205-2212, 2021.

[7] L. Zhang and Y. Chen, "Tenant-Landlord Management Portal: Improving Communication and Transparency," International Journal of Emerging Technologies in Engineering Research (IJETER), vol. 8, no. 11, pp. 156-163, 2020.

[8] O. Adeoye and T. Johnson, "Centralized Rental Property Management Using Modular Web Applications," Journal of Computer Applications and Research Vol. 7 No. 3 pp. 110-117, 2020.

[9] H. Singh and M. Chauhan, "Smart Housing: A Rental Management System with Secure Payment Gateway," International Journal of Engineering Research & Technology (IJERT), vol. 8, no. 7, pp. 1440-1447, 2019.

[10] R. Patel and A. Mehta, "Digital Rental Ecosystems: The Role of Automation and Data Analytics," International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT) Vol. 5 No. 12 pp. 455-462, 2019.