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### AN INTELLIGENT RULE-BASED SYSTEM FOR HOUSE RENTAL AGENCY MANAGEMENT

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#### ABSTRACT

*The continuous advancement of Technology has transformed various industries, including real estate management. This paper title An Intelligent Rule-Base House Rental Agency System focuses on the development of an intelligent system that simplifies and automates the process of renting houses. The system integrates rule-based functionalities such as chat-bot interaction, smart property recommendations, fraud detection, and digital rental management. The methodology employed in this study follows the Agile Software Development Model, which enables iterative development and consistent feedback from stakeholders. The system is implemented using HTML, CSS, JavaScript, PHP, and MySQL, with rule-based functionalities supported by Python. The system provides modules for tenants, landlords, administrators, and chat-bot. Key features include property listing management, intelligent property search, rent tracking, document management, and fraud prevention mechanisms*

**Keywords:** *Chat-bot, Rule based, Tenant, Landlord*

#### INTRODUCTION

The process of finding and renting houses has changed a lot due to technology. In the past, people looking for rental apartments or houses had to visit places in person, check manual listings, or work with local agents. This often led to delays, miscommunication, unfair suggestions, and even scams (Górska & Mazurczak, 2024). In fast-growing urban areas, especially in developing countries, these issues get worse because reliable property information is hard to find and rental practices can be inconsistent. Many tenants have shared experiences where; after paying rent, landlords still rented the house to someone else. This causes frustration, loss of trust, and financial

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problems (McKee et al., 2020). Likewise, landlords have a hard time finding trustworthy tenants, checking payment histories, and managing property details effectively.

Solutions to these issues have come about through improvements in an Intelligent Rule-Base House Rental System, although it may face some criticism. Along with its communication-saving, the system includes real-time recommendation algorithms. With automated contract monitoring, this system promotes transparency, efficiency, and rightfulness in the rental process. The real estate sector plays a pivotal role in national development, serving as a driver of economic growth, employment creation, and social welfare (Jahid, 2025). Demand for rental housing continues to increase due to rapid urbanization, population growth, and rural-to-urban migration (Nwalusi et al., 2022). However, the rental market remains fraught with inefficiencies such as double-booking of properties, lack of transparency, fraudulent practices, and poor communication between landlords and tenants. The rise of technologies has opened up new opportunities for automating and improving property rental services. Intelligent Rule-based, which are intelligent software systems that can reason, learn, and make decisions, are being integrated into real estate platforms. They offer smart property recommendations, chatbot-driven customer interaction, predictive analytics, and fraud detection (Fields, 2022). These Rule-based use machine learning algorithms, natural language processing (NLP), and user preference modeling to understand each user's unique needs and recommend appropriate rental options. The Intelligent Rule-Base House Rental Agency System aims to tackle ongoing challenges in the housing rental sector by using Intelligent Rule-Base to boost efficiency, accuracy, and user experience. The system enables users to interact with a Rule-based virtual agent that understands their preferences, such as location, price range, and type of apartment (bungalow, flat, etc.). It then provides the most suitable results in real-time. Besides personalized searches, the system offers features for managing property listings, user registration, dashboards, payment simulations, and analytics (Dahr et al., 2024). With Rule-based integration, the proposed solution not only lightens the workload for human agents but also reduces errors and biases. This makes the rental process clearer and more accessible. Intelligent Rule-based learn from past user interactions, which helps the system improve recommendations over time. As a result, users experience higher satisfaction and increased confidence in their decisions (Pamisetty, 2024). This paper aims to design and implement an Intelligent Rule-Base house rental platform that connects landlords, agents, and tenants through automation, data intelligence, and smart communication.

### **Related Work**

Rental housing plays a crucial role in both urban and rural areas, particularly for individuals who cannot afford to purchase property. The conventional rental process, involving manual registrations, in-person negotiations, and handwritten agreements, is often plagued by inefficiencies such as double bookings, expired leases, fraudulent claims, and inadequate documentation, as highlighted in local studies of (Gawrys & Carswell, 2020).

Early system-based approaches focused mainly on improving property administration processes. For example, Misyam and Selamat (2021) developed a rental house management system designed to support tenant management and rent collection through a centralized platform. While the

system improved operational efficiency, it relied heavily on manual input and lacked intelligent automation, which could result in issues such as double bookings.

However, most current implementations remain rule-based and lack deep natural-language understanding, which limits their adaptability and reduces overall user satisfaction (Xu & Cai, 2021). Advancements in conversational AI and contextual learning are expected to improve chatbot flexibility and personalization in future rental applications. Similarly, research on real estate recommender systems has highlighted the growing use of artificial intelligence for property recommendations. For instance, Tavakoli et al. (2022) explored AI-based recommendation approaches that help match users with suitable properties based on their preferences. However, such models primarily focus on user preference matching and often do not include fraud detection or risk assessment mechanisms. A broader discussion of real estate recommender systems and their challenges is presented in this survey.

Another study applied deep learning to evaluate affordability and tenant preferences, showing improved prediction accuracy. However, their framework does not integrate fraud prevention mechanisms, highlighting the continued fragmentation of AI solutions in rental systems (Yang et al., 2023). Wainwright (2023) put forth a rental platform featuring functions like tenant oversight, rent collection, and reporting capabilities. However, the lack of AI-driven automation leads to issues such as manual data input, incidences of double bookings, and limitations regarding scalability.

In another investigation by Jayadharshini et al. (2024) employed deep learning techniques to forecast rental affordability and tenant preferences, allowing both landlords and tenants to make more informed choices. In addition, predictive analytics has become an important research focus. Tekouabou et al. (2024) investigated machine learning techniques for fraud detection and property price prediction, demonstrating the potential of AI for improving real estate decision-making. However, their work mainly addresses property sales rather than rental markets. Related research also shows that machine learning models can effectively predict housing prices based on property characteristics and market conditions.

A web-based Rental House Management System was created by Andrew (2024) to help landlords with rent tracking and property listings. However, its efficacy is limited by its static nature and absence of intelligent features (such as automated recommendations or fraud detection), which results in enduring problems like double booking.

Recent research has explored the application of digital technologies and artificial intelligence in property management, rental platforms, and real estate decision-making. These studies demonstrate significant progress in automation, recommendation systems, and predictive analytics, although several limitations remain.

The digital transformation of real estate platforms has also been widely studied. Al-haimi et al. (2025) reviewed the emergence of digital property platforms and their role in modernizing real estate transactions. Their findings show that many platforms remain agent-driven and do not

incorporate advanced AI-based personalization. A related review of digital real estate technologies further highlights how technological tools are reshaping property markets.

Communication technologies have also gained attention in the literature. Subedi (2025) examined the use of chatbots for tenant communication and service support. These systems improve response time and automate customer interaction, but most implementations are rule-based and lack advanced natural language understanding. Research on AI adoption in property management broadly confirms that automation tools are increasingly used to improve ten-ant interaction.

Machine learning has also been applied to rental price prediction. A Adzanoukpe (2025) demonstrated that models such as CatBoost can accurately estimate rental prices based on property characteristics and location data. However, the system focuses mainly on price prediction and does not provide a full automated valuation or recommendation framework.

AI-powered chat-bots have become essential tools in property and hospitality management, providing 24-hour customer service, handling inquiries, facilitating bookings, and sending reminders. These capabilities can be effectively integrated into rental management systems to enhance responsiveness and user experience (Syah & Binesh, 2025). Personalized recommendation has also been explored from an affordability perspective. Rodrigues et al. (2026) proposed AI-driven recommender systems that assess user financial capability when suggesting properties. Although these systems enhance personalization, they often focus solely on affordability and do not incorporate fraud detection or behavioral risk analysis.

## Methodology

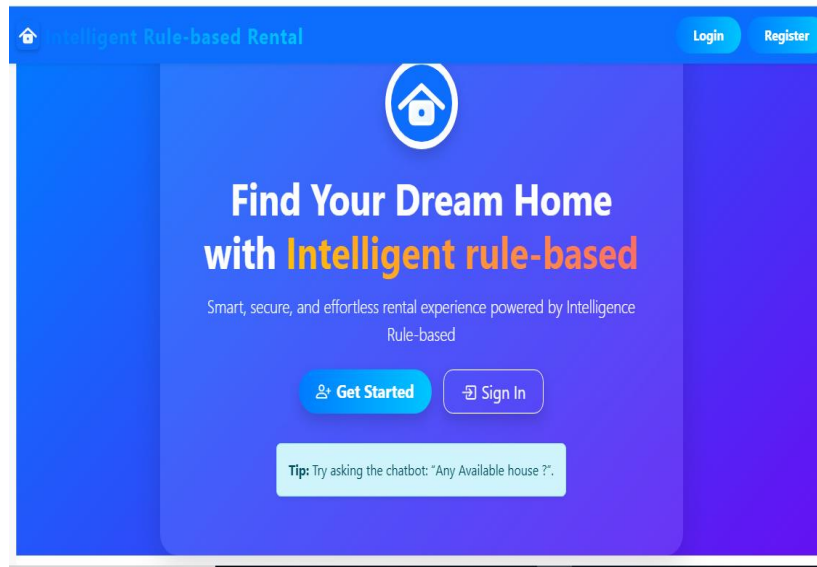
This paper utilizes a design and implementation approach. The design component focuses on creating an Intelligent Rule-Base House Rental Agency System that includes key features such as a chat-bot assisted search, property recommendations, fraud detection measures, and automated rental management. The implementation component involves converting these designs into a working system utilizing HTML, CSS, JavaScript, PHP, MySQL, an iterative development cycle is utilized to promote ongoing enhancement and active involvement of stakeholders. The Agile methodology serves as the foundational framework, facilitating incremental development of the system with regular feedback integration from landlords, tenants, and administrators.

## Results and Discussion

The system was built using a three-tier architecture, which comprises:

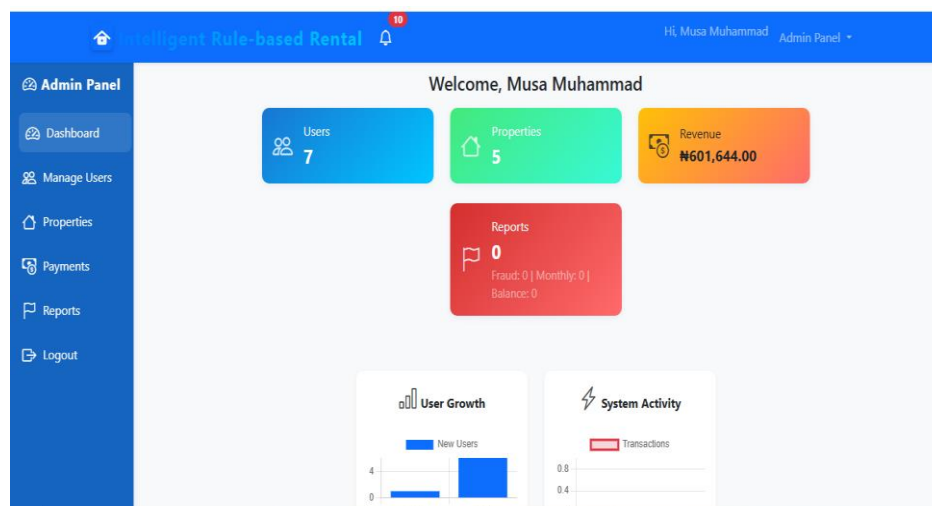
1. Frontend: HTML, CSS, and JavaScript were utilized to create responsive and interactive user interfaces.
2. Backend: PHP was used to handle server-side logic while Python facilitated rule-base processing and chat-bot integration.
3. Database: MySQL serves as the data storage solution, maintaining relational integrity and security.

The system was developed utilizing Intelligence Rule-based methods, including Natural Language Processing (NLP) for chat-bot interactions and rule-based recommendation algorithms for personalized property suggestions, using technologies like HTML, CSS, JavaScript, PHP, MySQL, and Python.



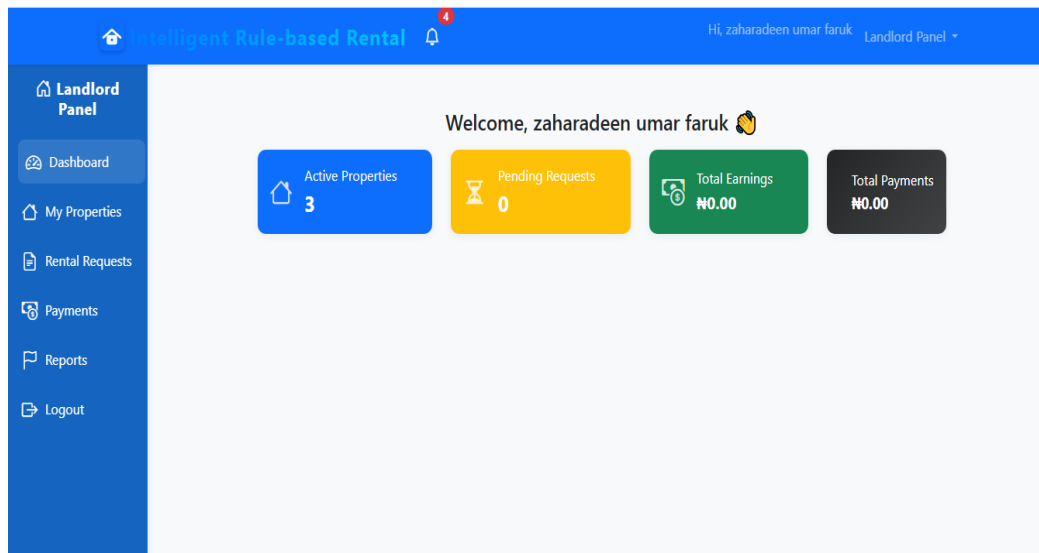
*Figure 1: shows the system's login page interface.*

Figure 4 presents the system login interface, which serves as the authentication gateway for all registered users (Tenant, Landlord, and Admin). The page allows users to securely enter their username and password to access their respective dashboards. Input validation and session management mechanisms are implemented to ensure secure authentication and prevent unauthorized access.



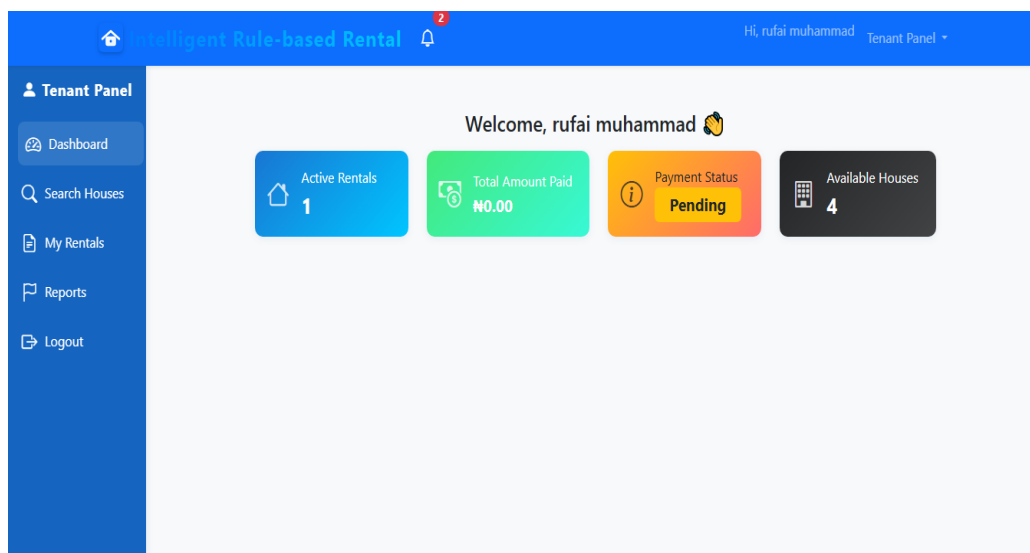
*Figure 2: Shows the admin dashboard here*

Figure 4 illustrates the Admin Dashboard, which provides centralized control over the entire rental system. The dashboard enables the administrator to manage users, monitor property listings, track rental transactions, generate reports, and oversee fraud detection activities. This interface ensures system transparency, security, and proper record management



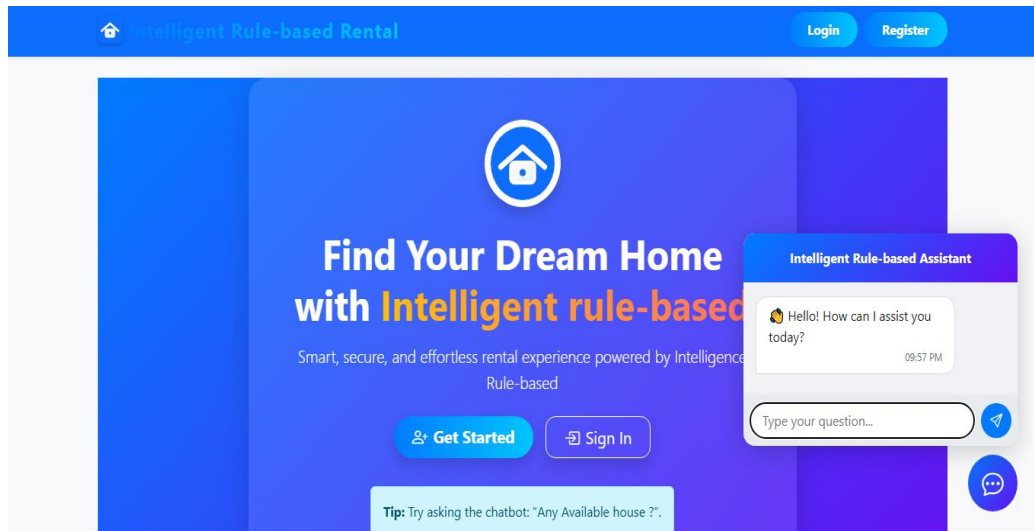
*Figure 3: Landlords dashboard*

Figure 3 shows the Landlord Dashboard, which allows property owners to manage their listings efficiently. Through this interface, landlords can add new properties, update property details, monitor rental requests and approve or reject bookings.



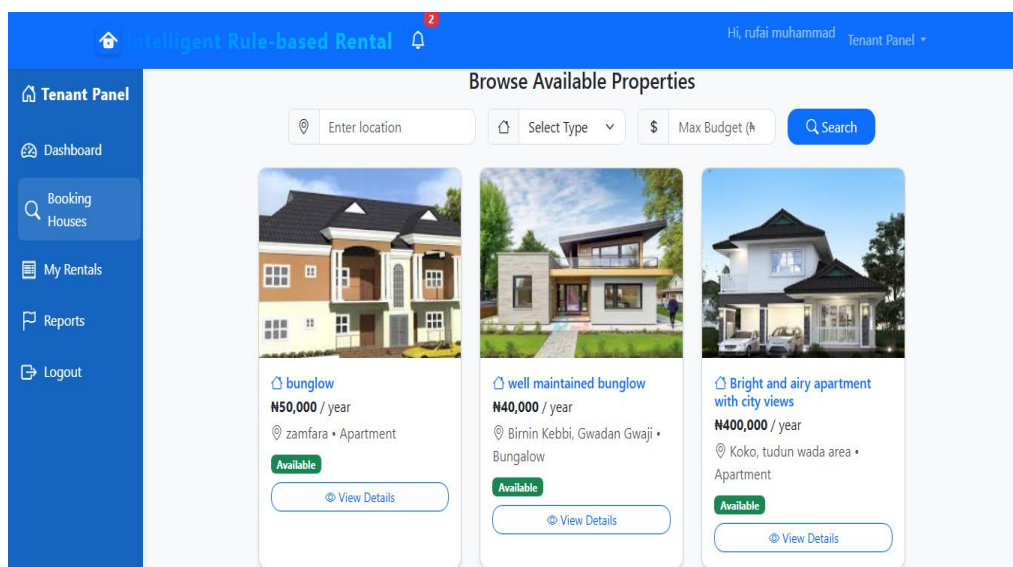
*Figure 4: Tenant dashboard*

Figure 4 presents the Tenant Dashboard, which provides tenants with access to property search tools, booking status, rental history, and system notifications. Tenants can interact with the intelligent chat-bot, view recommended properties based on their preferences, and track rental approval updates from landlords.



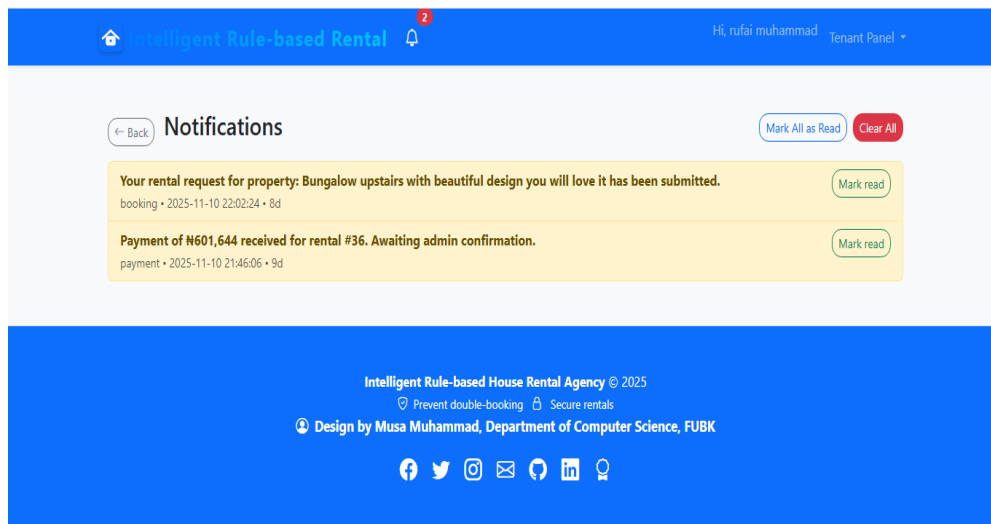
*Figure 5: Chat-bot Interface*

Figure 4.5 displays the chat-bot interface integrated with the Intelligent Rule-Based system. The chat-bot enables tenants to input rental preferences in natural language, such as location, price range, and apartment type. The system processes these inputs using rule-based logic and NLP techniques to generate personalized property recommendations in real-time.



*Figure 6: Search houses recommendations*

Figure 6 illustrates the property search and browsing interface, where users can filter available houses based on criteria such as location, price range, and property type. The interface displays organized property listings along with essential details, enabling tenants to compare options before submitting rental requests.



*Figure 7: Notification pages*

Figure 7 presents the notifications interface, which provides real-time updates to users regarding rental approvals, lease expiration reminders, booking confirmations, and system alerts. This feature enhances communication transparency between tenants, landlords, and administrators while ensuring timely action on rental activities.

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