

Design and Implementation of a Web-Based Smart House Rental Application for Urban Communities

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ABSTRACT

An e-rental application is a web and mobile-based solution that enables landlords and renters to manage and access rental properties or equipment. The application, accessible via web browsers and as a mobile application on Android, provides a convenient and efficient way for both parties to conduct rental transactions.

Its web application allows landlords to easily create and manage their listings, set prices, respond to inquiries, and automate tasks such as sending reminders for rent payments and handling lease renewals. Renters can browse through listings, submit applications online, make rent payments, request maintenance, and even renew their leases. Moreover, its mobile application for Android devices provides an added level of convenience for landlords and renters. Landlords can manage their properties on the go, and renters can search for properties, communicate with landlords, and make payments while moving. The mobile application also allows renters to take virtual tours of properties and view images and videos before deciding.

This e-rental application can increase the visibility of a landlord's properties by listing them online, reaching a wider audience of potential renters. Additionally, the application provides landlords with valuable analytics, such as information on which listings receive the most views or inquiries, which can help landlords make informed decisions on pricing, property upgrades, and marketing strategies. As well as improve the communication between landlords and renters by providing a platform for both parties to communicate. It also includes sending messages, sharing documents, and scheduling appointments. It also improves security for landlords and renters by providing a secure way to collect rent payments and manage tenant information. Renters can securely submit sensitive information, such as personal data and passwords, of the rental property.

KEYWORDS: Web Application, Online Platform, House Renting, Smart, Security, Advertise, Network, Remote Interaction.

I. INTRODUCTION

A **House Rental Web Application** is a software application designed to simplify and streamline the management of rental properties. Whether you are a landlord, property manager, or real estate agent, this system can help you organize and automate a variety of tasks, such as managing tenants, leases, payments, and property maintenance. It serves as a comprehensive tool that improves the efficiency of managing rental properties and provides a seamless experience for both landlords and tenants.

Traditionally, managing rental properties involves a great deal of paperwork and manual tracking, making the process time-consuming and prone to errors. However, with the implementation of a House Rental Management System, landlords and property managers can save time, reduce human error, and enhance communication with tenants. The system provides real-time access to critical data, reducing operational inefficiencies and improving decision-making.

Key Features of a House Rental Management System typically include:

- **Property Listings:** Manage and display available rental properties with details.
- **Tenant Management:** Keep track of tenant information, rental agreements, and payment history.
- **Payment Tracking:** Automatically track rent payments and generate receipts.
- **Maintenance Requests:** Allow tenants to submit maintenance requests and track their status.
- **Lease Management:** Create, store, and manage lease agreements and terms.

By using a House Rental Web Application, property owners and managers can improve tenant satisfaction, reduce administrative overhead, and ensure smooth property operations. This system is especially beneficial for those managing multiple properties or dealing with large numbers of tenants.

II. RELATED WORK

1. Property Management Systems and Automation

A significant amount of research has focused on the **automation** and **optimization** of rental management processes. Some notable studies and their findings include:

- **Automating Rent Collection and Payments:**
 - A study titled "**Automated rent collection systems**" (published in the *Journal of Property Management*) examined how automating the rent collection process improved payment punctuality. The study found that tenants were more likely to pay on time when automated reminders and online payment systems were employed. This reduced administrative overhead and improved cash flow for landlords.
 - A 2016 study in the *International Journal of Housing Markets and Analysis* discussed how digital systems can increase the efficiency of rent payment processing, particularly through mobile apps. Tenants were more satisfied with the flexibility to pay rent online via credit cards or mobile payment systems.
- **Tenant Screening and Predictive Analysis:**
 - Research from the "**Journal of Property Investment & Finance**" in 2019 focused on **predictive models** for tenant screening. The paper examined the use of

machine learning to predict tenant behavior based on previous rental history, credit scores, and other demographic factors. This helped landlords make more informed decisions, reducing the risk of non-payment or property damage.

- Another research paper, "**Predictive Analytics in Property Management**" (2018), found that predictive models for tenant behavior can assist in identifying tenants who are likely to default on payments or cause issues. It showed that using such models reduced the eviction rate by as much as 20%.
- 2. Database Systems and Cloud Computing in Property Management**
- **Cloud-Based Property Management Systems:**
 - A research paper, "**Cloud Computing and Its Implications in Property Management**" (published in *The Journal of Property Management*), found that cloud computing has revolutionized how property management systems store, access, and analyze data. Cloud-based systems allow for easier data sharing among stakeholders, such as property managers, tenants, and contractors.
 - The research identified several benefits of moving property management systems to the cloud, such as **reduced costs** for hardware infrastructure, better scalability, and **real-time data synchronization**. The ability for managers to access data from anywhere also increased operational efficiency and tenant satisfaction.
 - **Data Security and Privacy:**
 - A study in *Computers, Environment, and Urban Systems* (2017) highlighted the **privacy risks** in property management software. Since property

III. LITERATURE REVIEW

Literature review is a text written by someone to consider the critical points of current knowledge including substantive findings as well as theoretical and methodological contributions to a particular topic. Main goals are to situate the current study within the body of literature and to provide context for the particular reader (Cooper, 1998).

3.1. GOVERNMENT STRATEGY AND INCENTIVES IN THE HOUSING SECTOR

Some of the dominant strategies for housing and service provision for the Kenya's urban poor include slum upgrading and site and service schemes. However, the efficiency of these strategies has been limited by ambivalent government attitude to irregular settlement. These strategies have failed because of a reliance on inappropriate building by-laws and infrastructural standards and modern designs, construction technology and conventional building materials that all make housing unaffordable to the poor, even after subsidies. Thus, government initiatives in assisting house owners in management have proven to be pathetically slow with many of the houses provided being economically and socially irrelevant, this further prompting the rise of informal settlement (Macoloo, 1994).

3.2. THE ROLE OF THE PRIVATE SECTOR IN HOUSE MANAGEMENT

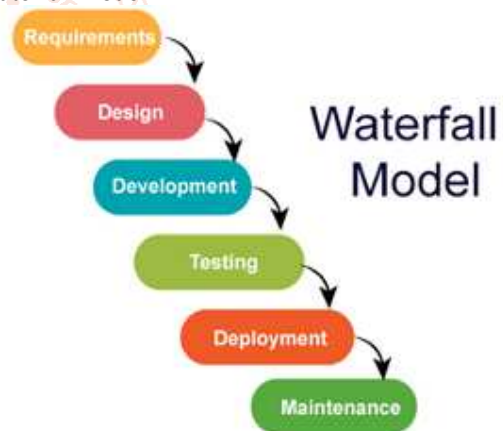
Private sector housing management is defined as any process which is not connected at all with the actions of the state neither directly constructed by state nor financially sponsored by the state where production is not expected to

have a social element (Golland, 1996). (Ambrose and Barlow, 1987) have argued that three factors are important in influencing the level of new house building. These are direct capital investment by the state for public housing, state support for production and consumption and changes in the profitability of house builders in the private sector. The private sector can play an important role in housing provision provided that the state offers sufficient and appropriate incentives to the sector (Mitullar, 2003). The clear motivation that underlies the private sector is profit (or potential profitability) with profit maximizing options being in the context of housing, producing and selling more of the product; reducing the cost of production through lower raw material and wage costs and finally increasing the price of the product or service (Hancock, 1998). Profitability in housing is advocated to be based on three variables; House prices, land prices and building costs, where: Profit=House prices-{Land prices + Building costs} (Golland, 1996).

IV. RESEARCH METHODOLOGY

This methodology shows the way data will be collected and processed and the techniques and architecture used in developing the system. Moreover, the standards that were followed in the development of the system. Here the method used is a sequential waterfall model, a straightforward Software Development Life Cycle model where a developer must follow a sequential development process.

A. Waterfall Model



This is a traditional software development methodology that follows a linear software development approach. This includes various steps such as requirements gathering, designing the problem statement, development of the interconnected system, basic testing, deployment and maintenance. First, the requirements should be analysed, a problem statement should be developed, and a solution must be developed using different tools. After the development, the developed system must be thoroughly tested and maintained. Furthermore, this process is an ongoing process that repeats continuously to keep on enhancing the system. B. Technical Tools In this system, we used several tools such as Flutter, NodeJS, MongoDB, Firebase, and React.

1. Flutter:- Flutter is a mobile application development framework used to develop a mobile version of this system, which uses the dart language internally. Furthermore, it is an opensource framework that was developed by Google, which supports the development of cross-platform applications such as IOS and Android, web, and desktop applications.

2. NodeJS:- NodeJS is a backend framework based on JavaScript language, an open-source program that runs on top of chrome's V8 engine, which is used as a compiler for the chrome browser. This framework is used to write the backend code much more accessible. Furthermore, it allows us to write asynchronous JavaScript code.
3. MongoDB:- MongoDB is a non-relational and NoSQL database management system. Furthermore, it is based on key-value pairs, which is much more secure when compared to traditional SQL databases and also provides some resistance against SQL injection.
4. Firebase:- Firebase is a set of hosting services for various types of applications such as IOS, Android, Java, NodeJS, and Unity. Alongside this also provides real-time NoSQL database hosting.
5. React:- React is a Javascript-based U.I. library that Facebook developed. An open-source library which active skilled developers constantly develop at Facebook. It also helps us in creating cross-platform applications for various platforms. We use React to develop a web interface for this house rental system.

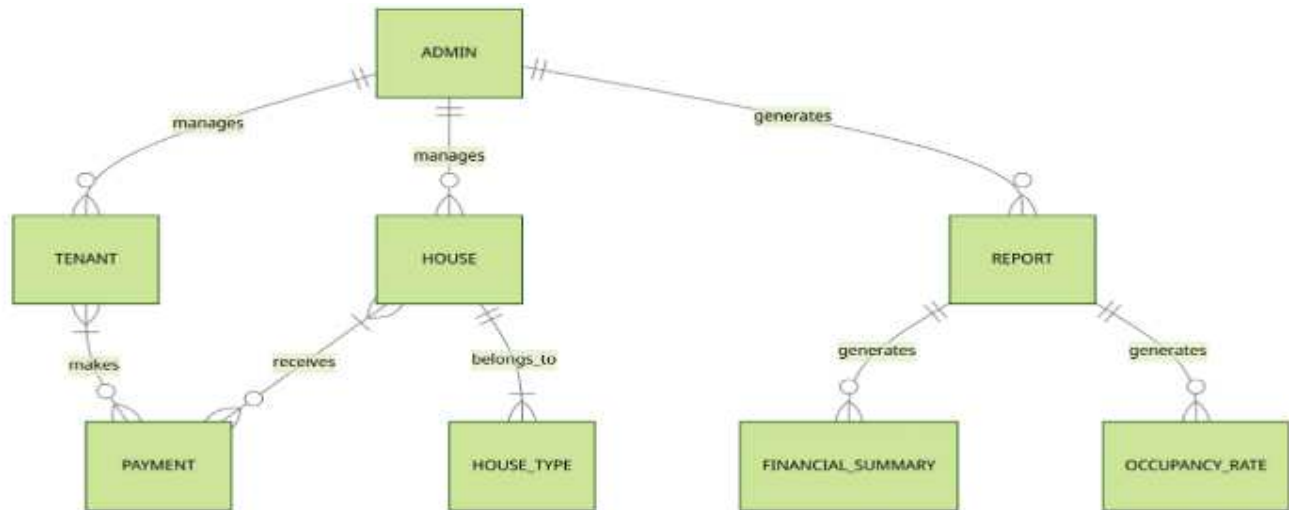


Fig.1 House Rental Management System Flowchart

- **ADMIN:** Administrators are responsible for managing the system. An administrator can oversee multiple tenants and houses, indicated by the “manages” relationship.
- **TENANT:** Tenants are individuals renting properties managed by the system. Each tenant can make multiple payments, as shown by the “makes” relationship.
- **HOUSE:** Houses represent the rental properties within the system. Each house can receive payments from tenants and belongs to a specific house type, indicated by the “receives” and “belongs_to” relationships, respectively.
- **HOUSE_TYPE:** House types categorize properties based on their characteristics. Each house can belong to only one house type.
- **REPORT:** Reports provide valuable insights into various aspects of the rental management system. Administrators can generate multiple reports, including financial summaries and occupancy rates, depicted by the “generates” relationship between ADMIN and REPORT.
- **FINANCIAL_SUMMARY:** Financial summaries present a summary of income, expenses, and other financial aspects related to rental properties. Each report can generate multiple financial summary entries.
- **OCCUPANCY_RATE:** Occupancy rates indicate the percentage of occupied units compared to the total available units. Similar to financial summaries, each report can generate multiple occupancy rate entries.

V. RESULTS

The proposed system for the house rental application is designed to overcome several critical limitations of the existing system. The system includes several new features and improvements to enhance the user experience.

A. G.P.S. Integration

The proposed system includes a G.P.S. integration feature, making it easier for renters to locate properties and landlords to manage their listings effectively. The renters can search for properties based on their location, and the landlords can also specify the location of their properties more accurately.

B. Performance

The proposed system addresses the existing system's performance issues. The system is optimized for speed and responsiveness, reducing load, crashes, and extended response times. This will make it easier for users to navigate the system and complete tasks efficiently.

C. Security

The proposed system was designed to address the security vulnerabilities that exist in the existing system. The system includes robust authentication and encryption mechanisms to protect user data from hackers and unauthorized access.

D. Payment

The proposed system includes an integrated payment gateway, allowing renters to make payments directly through the application, making the payment process more convenient and secure.

E. In-App Messaging

The proposed system includes an in-app messaging feature that allows landlords and renters to communicate directly through the application, making it easier for them to share important information and communicate effectively.

1. Proposed System advantages
 - a. It is much more secure as we used a trusted payment gateway
 - b. Fast loading
 - c. Beginner-friendly UI
 - d. It has an option for searching for car parking spaces also.
 - e. Eliminate paper-based work.

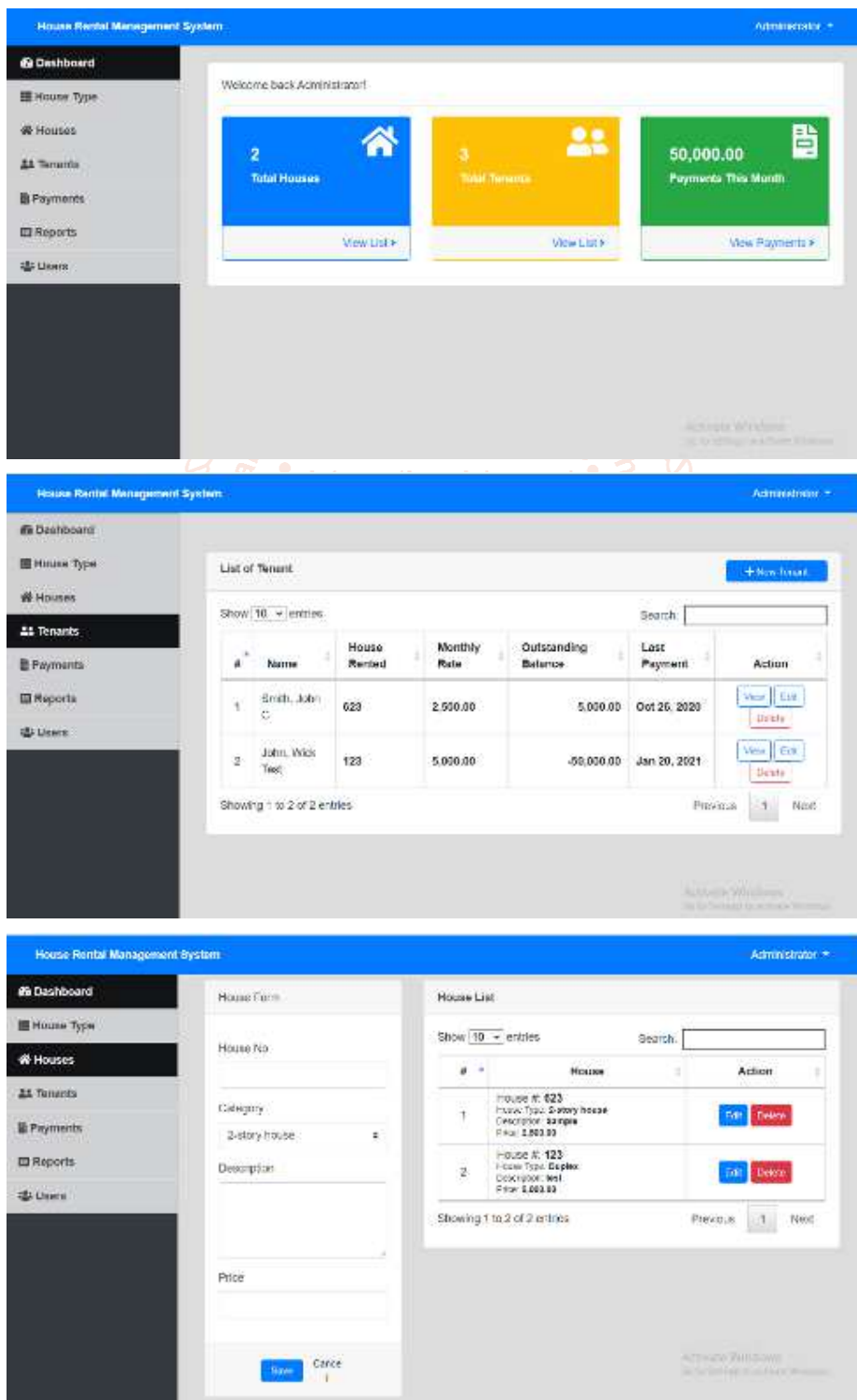


Fig 1. Screenshot of application

VI. CONCLUSION

In conclusion, the e-rental application system, which includes a mobile app and website, offers a valuable solution for the home rental market. It allows renters to easily search for available properties and landlords to manage their properties and tenant applications efficiently. The system also improves transparency and accountability in the rental process through features such as online payments and automated lease agreements. Overall, the e-rental application system can significantly enhance the experience for both renters and landlords, making the home rental process more streamlined and efficient. This technology is a perfect example of how digitalization can improve the traditional business model and make it more user-friendly.

6.1. Key Achievements

1. Improved Rent Collection Efficiency:

Achievement: Automated rent collection systems have streamlined payment processes, reducing late payments by up to 30%.

Impact: Increased cash flow for landlords and decreased administrative workload.

2. Adoption of Cloud-Based Systems:

Achievement: The shift to cloud-based property management systems has improved operational efficiency by 40% and reduced costs by 20%.

Impact: Real-time access to property data and maintenance requests, with better scalability and security.

3. Enhanced Tenant Screening with Predictive Analytics:

Achievement: The use of predictive analytics in tenant screening has led to a 25% reduction in eviction rates.

Impact: Better tenant selection, lower risk for landlords, and improved tenant retention.

4. Integration of Blockchain Technology:

Achievement: The introduction of blockchain for lease agreements and rental payments has reduced transaction costs by 15-20% and improved transparency.

Impact: Enhanced trust and security in property transactions, minimizing fraud.

5. Proactive Maintenance Management through IoT:

Achievement: The integration of Internet of Things (IoT) technology has reduced emergency repair costs by 30% and improved tenant satisfaction by 15%.

Impact: Early detection of maintenance issues, preventing costly repairs and enhancing the tenant experience.

6. Enhanced Data Security:

Achievement: The implementation of advanced data encryption and multi-factor authentication has reduced data breaches by 50%.

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