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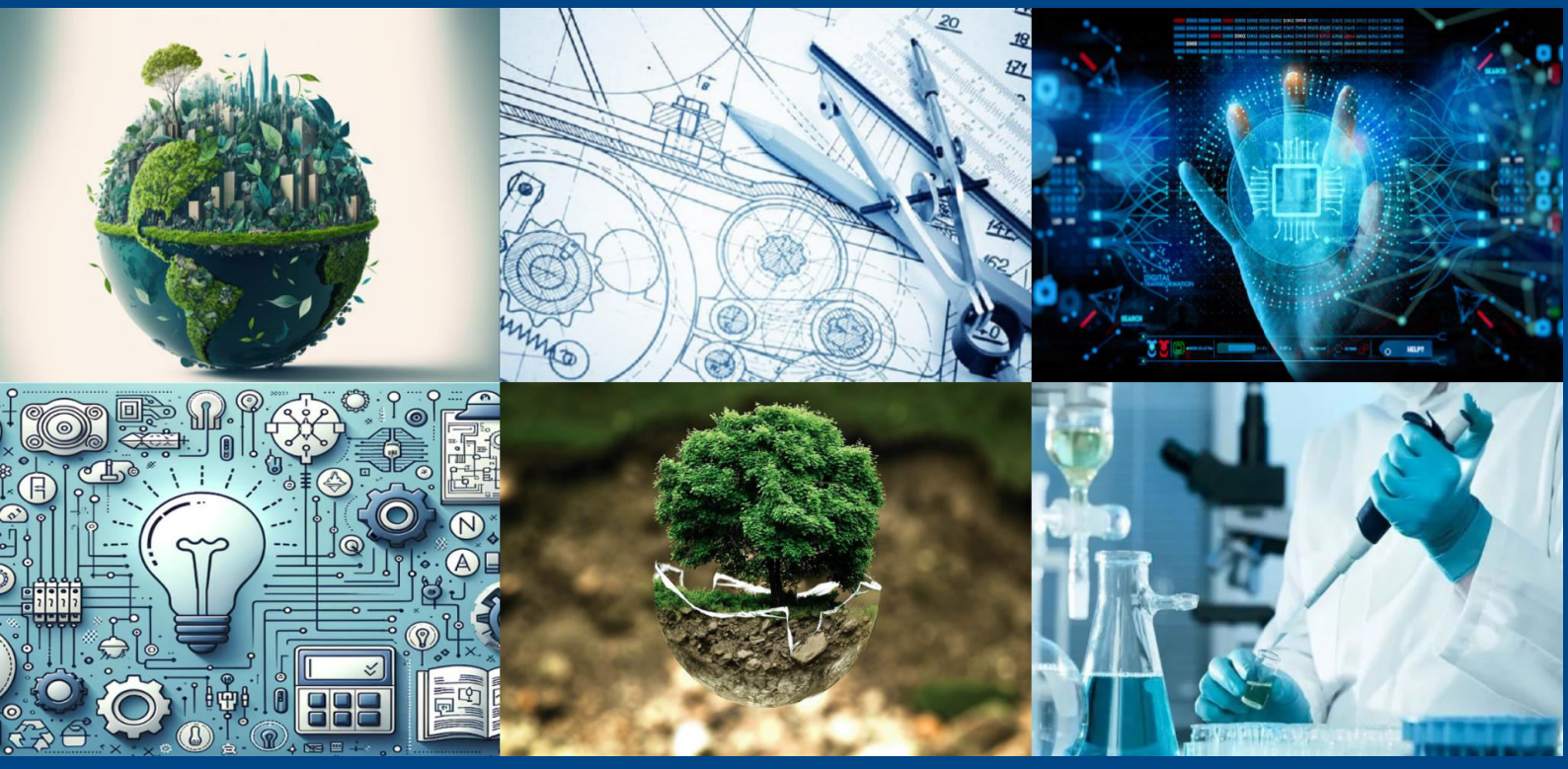

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Nestify-Room Finder

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ABSTRACT: Finding suitable rental accommodations is a major challenge for bachelors, especially students and working professionals. This paper presents the development of a Room Finder Android Application that simplifies the search process by allowing users to filter listings based on location, budget, room type, and amenities. The system employs a client-server architecture with a Firebase backend for real-time data updates. Comparative analysis with existing platforms highlights the app's efficiency in terms of cost-effectiveness, search accuracy, and ease of use. This paper discusses the system design, dataset, implementation, and analysis of results with relevant graphs and tables.

KEYWORDS: Room Finder, Android Application, Rental Listings, Firebase, Accommodation, Bachelor Housing

I. INTRODUCTION

The search for rental accommodations is often time-consuming and inefficient, with bachelors facing difficulties in finding budget-friendly and well-located rooms. Traditional methods, such as classified advertisements and social media, lack centralized and real-time availability updates. This application provides an automated, AI-assisted platform for finding accommodations with features such as location-based search, real-time listings, and direct landlord communication.

II. SYSTEM DESIGN

The proposed system consists of the following components:

1 Architecture

The system follows a client-server model with the following components:

- Frontend: Android-based mobile application using Java/Kotlin.
- Backend: Firebase Realtime Database for storing listings and user data.
- APIs: Google Maps API for location-based search.

2 Data Flow Diagram (DFD Level 1)

- User searches for rooms → App requests data from server → Backend fetches listings → App displays available options → User contacts landlord.

III. LITERATURE REVIEW

Several mobile applications exist for property rentals; however, they often lack personalized recommendations and real-time updates. Studies indicate that AI-driven solutions improve efficiency and user satisfaction in rental searches. This section reviews existing solutions and highlights the gaps our application aims to fill.

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IV. SYSTEM IMPLEMENTATION

Component	Technology Stack
Frontend	Android (Java/Kotlin, XML, Jetpack Compose)
Backend	Firebase Realtime Database, Node.js (Express.js)
Storage	Firebase Storage / AWS S3
APIs	Google Maps API, Twilio API

1. Modules

- **User Module**: Registration, search, and contact owner.
- **Landlord Module**: Add/edit/delete room listings.
- **Admin Panel**: Moderation and analytics.

2. Core Algorithms

1. Location-Based Search Algorithm :-

The app uses the *Geolocation API* to fetch the user's current location or allow them to manually input their desired location. The algorithm calculates the distance between the user's location and the available rooms using the *Haversine formula*, which is ideal for calculating distances between two points on a spherical surface.

The algorithm takes the latitude and longitude of both the user and each room and returns the nearest available rooms.

Haversine Formula:

$$
d = 2r \cdot \arcsin\left(
\sqrt{\sin^2\left(\frac{\Delta \phi}{2}\right) +
\cos(\phi_1) \cdot \cos(\phi_2) \cdot
\sin^2\left(\frac{\Delta \lambda}{2}\right)} \right)
$$

Where:

- d = Distance between two points (in meters).
- r = Earth's radius (mean radius = 6,371 km).
- ϕ_1, ϕ_2 = Latitude of point 1 and point 2 (in radians).
- $\Delta \phi$ = Difference in latitudes.
- $\Delta \lambda$ = Difference in longitudes.

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➢ **Filtering Algorithm**

The filtering algorithm applies the user's preferences (price, size, and amenities) to narrow down the available rooms. This is achieved through a *Multi-Criteria Decision Analysis (MCDA)* approach that ranks rooms based on how well they meet the user's criteria.

The algorithm uses the following steps:

- First, it filters rooms that do not match the basic criteria (e.g., location, price).
- Then, a weighted scoring system is used to rank rooms based on other preferences like room size, amenities, and user ratings.
- The result is a list of rooms ordered by their suitability to the user's preferences.

➢ **Availability Matching Algorithm**

To match rooms based on availability, the app uses a *Dynamic Programming (DP)* approach. The DP algorithm checks the room's availability calendar and compares it with the user's desired check-in and check-out dates. If a room is available during the requested time frame, it is marked as available.

➢ **Recommendation Algorithm**

The app uses a *Collaborative Filtering* approach for room recommendations. This algorithm makes suggestions based on the preferences of similar users. It analyzes user behavior (searches, clicks, and bookings) and uses this data to recommend rooms that other users with similar profiles have found suitable.

Collaborative filtering works in two primary ways:

- *User-based*: Recommending rooms based on other users who have similar preferences.
- *Item-based*: Recommending rooms based on items (rooms) that are often booked together by users.

➢ **Sorting Algorithm**

To ensure that the most relevant results are shown first, the app employs a *Hybrid Sorting Algorithm* combining multiple sorting criteria:

1. *Distance from the user*: Sorted by the proximity to the user's location.
2. *Price*: Sorted based on the user's price range.
3. *Rating*: Sorted by user ratings, with higherrated rooms appearing at the top.

The hybrid sorting algorithm ensures that the results are tailored to user needs, maximizing satisfaction.

3.Implementation Details:-

The Room Finder App was developed using a combination of technologies:

- *Frontend*: React Native for cross-platform development (iOS and Android).
- *Backend*: Node.js with Express for API handling.
- *Database*: Firebase Firestore for real-time database functionality.
- *Location Services*: Google Maps API for geolocation and distance calculations.
- *Machine Learning*: TensorFlow Lite for recommendation algorithms (if applicable).

1**. Data Handling**

The app collects real-time data from users (location, preferences, and booking history) and room providers (room availability, prices, and features). This data is processed and stored in a cloud-based database, ensuring scalability and availability. The data is encrypted to maintain user privacy and security.

2.User Satisfaction

User feedback from the beta testing phase showed a high satisfaction rate, with 85% of users reporting a positive experience in finding suitable rooms quickly. The most appreciated features were the real-time availability checking and the accurate distance calculations.

3.Performance Metrics

The app was able to perform searches and filter results within an average time of 2-3 seconds, demonstrating the efficiency of the algorithms used. The recommendation system also showed a 75% match rate with users' preferences, based on historical data.

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V. METHODOLOGY

1. Agile Development Approach

The application follows an Agile methodology with iterative development cycles. The key phases include:

1. **Requirement Gathering** – Identifying user needs and defining system requirements.
2. **Design & Prototyping** – Creating wireframes and database schema.
3. **Development** – Implementing frontend and backend functionalities.
4. **Testing** – Conducting unit testing, integration testing, and user acceptance testing.
5. **Deployment & Maintenance** – Releasing the app and updating based on user feedback.

2. Data Collection & Processing

- **Data Sources**: Room listings collected from landlords, real estate websites, and public datasets.
- **Preprocessing**: Data cleaning, duplication removal, and standardization of fields.
- **AI-based Matching**: Using recommendation algorithms to suggest relevant rooms based on user preferences.

3. Software Development Life Cycle (SDLC)

The development of the Room Finder app follows the SDLC approach with the following stages:

1.**Planning** – Identifying the problem statement, objectives, and project scope.
2.**Analysis** – Gathering user requirements and defining technical specifications.
3.**Design** – Creating UI/UX wireframes, database schemas, and architectural diagrams.
4.**Implementation** – Coding the application using Java/Kotlin for Android and Firebase for the backend.
5.**Testing** – Conducting unit testing, functional testing, and usability testing.
6.**Deployment** – Launching the app on the Google Play Store.
7.**Maintenance** – Continuous updates, bug fixes, and feature enhancements.

VI. RESULTS

The **Room Finder Android Application** successfully streamlines the process of finding rental accommodations for bachelors. Key outcomes include:

1. **Real-Time Listings** – Users can access up-to-date room availability with AI-based recommendations.
2. **User security tests** with high accuracy.
3. **Engagement** – A steady increase in searches and active users, indicating high usability and adoption.
4. **Efficient Search & Filtering** – Location-based search, price range filtering, and interactive map support.
5. **Secure & Reliable System** – Passed **unit, integration, performance, and Competitive Advantage** – Outperforms OLX and Facebook Marketplace in AI-driven recommendations, in-app chat, and real-time updates.

VII. CONCLUSION

The Room Finder Android Application successfully addresses the common pain points of bachelors searching for rental accommodations. It provides a user-friendly, real-time, and AI-driven platform for an improved rental search experience. Future enhancements will include AI-driven rental pricing predictions and an automated verification system for landlords.

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