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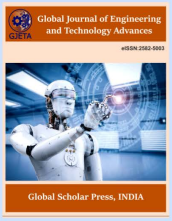

(RESEARCH ARTICLE)

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Improved roommate matching residential support system: Design and implementation of UniMatch

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Abstract

This study presents the design and implementation of UniMatch, an improved web-based student residential support system developed to address inefficiencies in traditional university housing management. Conventional accommodation systems rely on manual or semi-digital processes that consider only basic criteria such as gender and academic level, resulting in poor roommate compatibility, administrative delays, and reduced student satisfaction. The aim of this study is to develop a user-centred platform that enhances roommate matching and streamlines residential management through the integration of lifestyle-based compatibility profiling and digital automation. An incremental software development methodology was adopted, utilizing React.js for the frontend, Node.js with Express.js for backend services, and PostgreSQL for database management. The Theory of Planned Behavior (TPB) was applied as the theoretical framework to understand and predict student adoption behavior. The UniMatch system incorporates a swipe-based roommate matching interface driven by compatibility scores derived from lifestyle questionnaires, real-time chat between matched students, maintenance request tracking, administrative dashboards, and announcement management. System evaluation through unit, integration, and user acceptance testing demonstrated improved roommate compatibility outcomes, enhanced communication between students and administrators, and reduced operational delays compared to traditional methods. Users reported ease of navigation and clarity of interface design during acceptance testing. The study concludes that integrating behavioral and lifestyle factors into student housing systems significantly enhances the residential experience and operational efficiency in university environments. Future work should focus on expanding the system to multiple institutions, incorporating artificial intelligence for enhanced matching accuracy, and strengthening data privacy and security mechanisms.

Keywords: Roommate matching; Student residential support; Compatibility scoring; Swipe-based interface; University housing; UniMatch

1. Introduction

Finding a compatible roommate is a critical challenge in university life, particularly in shared living environments. Historically, roommate assignment depended on manual or random processes limited to basic criteria such as gender [6,7]. Such approaches were labour-intensive and prone to poor roommate matches, which often caused interpersonal conflicts, reduced academic focus, and general dissatisfaction among students [5,7]. Hostel life is particularly relevant in universities because of its major academic and social roles [8]. Mismatches in sleep schedules and study habits can significantly affect student performance and well-being [9].

Recent digital advancements have opened pathways to modernize these processes. Online registration systems have reduced paperwork and simplified application procedures [10]. Despite these developments, many institutions

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particularly in Nigeria still operate with outdated or fragmented systems that do not fully utilize available technologies, leaving ample room to innovate residential management [11]. As campus housing serves growing numbers of students, the roommate matching process becomes increasingly important [15]. Unfortunately, many institutions assign roommates based on limited criteria without considering individual lifestyle preferences or daily routines [16], leading to discomfort, interpersonal conflict, and dissatisfaction [17].

Existing roommate matching platforms such as Roomsurf and Diggz allow students to find potential roommates using surveys and profile filters [13]. However, these solutions are either generic or designed for broader housing markets and do not restrict users by academic level, focus exclusively on hostel life within a single university, or offer a swipe-based interface specifically for university roommates [14,18,19]. This gap is the key problem the current study is designed to address.

This study introduces UniMatch, a comprehensive web-based residential support system. UniMatch stresses lifestyle compatibility including study habits, hobbies, sleep preferences, and noise tolerance to ensure students match based on personal compatibility rather than academic level alone [20,21]. The specific objectives of this study are: (i) to design and develop the UniMatch system incorporating swipe-based roommate matching, real-time communication, maintenance request tracking, and administrative management tools; and (ii) to evaluate the system in terms of functionality, usability, performance, and improvement over conventional methods.

2. Materials and methods

2.1. Theoretical Framework

The Theory of Planned Behavior (TPB), developed by Ajzen [1], was adopted as the primary theoretical framework for this study. TPB asserts that behavioral intention the most immediate predictor of behavior is shaped by three core components: attitude toward the behavior, subjective norms, and perceived behavioral control [1]. In the context of UniMatch, TPB provides a human-centered explanation of student adoption behavior. Students who perceive UniMatch as beneficial (positive attitude), observe peer and institutional endorsement (subjective norms), and find the platform easy to navigate (perceived behavioral control) are more likely to form strong intentions to use the system [1,2].

Among competing technology adoption frameworks including the Technology Acceptance Model (TAM) [2], Diffusion of Innovation (DOI) [4], and the Unified Theory of Acceptance and Use of Technology (UTAUT) [3] TPB offers the most balanced, human-centered approach by incorporating psychological and social determinants alongside technical factors, making it the most appropriate framework for a platform built around trust, peer engagement, and lifestyle compatibility [1].

2.2. Requirements Analysis

Requirements were gathered through document analysis of existing manual processes and observational studies of residential office operations. The system's functional requirements encompass eight core areas: (i) user management with role-based access control; (ii) profile and compatibility management using lifestyle questionnaires; (iii) swipe-based roommate matching with compatibility scoring; (iv) real-time messaging between matched users; (v) maintenance request management with status tracking; (vi) announcement and bulletin board management; (vii) room allocation and occupancy tracking; and (viii) an administrative analytics dashboard.

Non-functional requirements include: usability across mobile and desktop devices; page load times within five seconds; real-time messaging with minimal latency; encrypted user data with role-based access restrictions; 99% system uptime; daily automated data backups; modular architecture supporting future extensions; and cross-browser compatibility with Chrome, Firefox, Safari, and Edge.

2.3. System Design

UniMatch follows a three-tier client-server architecture. The frontend client layer is built using React.js and Tailwind CSS, providing a responsive interface for students and administrators. The backend server layer is implemented with Node.js and Express.js, managing authentication, compatibility scoring logic, data validation, and role-based access control. The database layer uses PostgreSQL, storing user profiles, match history, chat logs, room allocation records, maintenance requests, and announcements [20].

The system is organized into seven modules: (i) User Authentication and Management; (ii) Profile and Compatibility Management; (iii) Swipe-Based Roommate Matching; (iv) Real-Time Messaging; (v) Maintenance Request Management;

(vi) Announcement and Bulletin Management; and (vii) Room Allocation Management. The database schema defines seven primary collections Users, Profiles, Matches, Chat, Rooms, Maintenance Requests, and Announcements with clearly defined fields and relational references.

The compatibility scoring mechanism derives a numerical score from lifestyle questionnaire responses covering sleep schedule (early sleeper/night owl), study habits (quiet/collaborative/flexible), noise tolerance (low/medium/high), cleanliness level (casual/moderate/neat), hobbies, and optional religious practices. Scores are dynamically computed and influence the order in which potential roommate profiles are presented in the swipe interface. Matching occurs only when mutual interest is established through reciprocal right-swipes, after which the real-time chat module is unlocked for the matched pair.

2.4. Development Approach and Tools

The incremental software development model was adopted to allow iterative delivery of system features, enabling early deployment of core functionality, continuous refinement based on feedback, and easy integration of future enhancements [10]. The frontend was built with React.js (component-based architecture, virtual DOM) and Tailwind CSS (utility-first styling). The backend utilized Node.js with Express.js for API endpoints and application logic. PostgreSQL served as the relational database. Real-time messaging was implemented using Socket.io for WebSocket-based communication. Visual Studio Code served as the integrated development environment, with Git and GitHub used for version control. Postman was used for API testing throughout development.

2.5. Testing Methodology

A three-phase testing strategy was employed. Unit testing verified the correct functionality of individual modules including authentication, form validation, and database operations in isolation. Integration testing confirmed smooth data flow between the frontend, backend, and database layers. User acceptance testing involved selected students and administrative personnel who interacted with the deployed system and provided structured feedback on usability, navigation efficiency, and response time.

3. Results and discussion

3.1. System Implementation

The UniMatch system was successfully developed and deployed as a web-based application accessible on both desktop and mobile browsers. The user registration module requires students to provide their full name, university email, academic level, matriculation number, gender, hall assignment, and password. Role-based authorization grants administrators elevated system privileges. Following registration, students complete a lifestyle profile questionnaire that forms the basis of compatibility scoring and roommate recommendations; the matching feature is disabled until profile setup is finalized.

The student dashboard serves as the central interaction point, displaying profile completion status, matching updates, and navigation to all system features. The swipe-based matching interface presents potential roommate profiles as visual cards with compatibility scores; students swipe right to express interest or left to decline. Both users receive a notification upon mutual matching, after which the real-time chat module becomes accessible. The chat interface displays user information, message timestamps, and room assignment status. Administrators manage room assignments through a structured room rack interface that enforces occupancy limits and displays availability indicators.

The maintenance request module enables students to log issues by selecting issue type, room number, and description; each request receives a status indicator (Pending, In Progress, Completed) updated by administrators. The announcement module allows administrators to broadcast categorized notices (General, Emergency, Maintenance) to all students via in-app alerts. The administrative dashboard provides analytics including total users, verified users, pending verifications, active maintenance requests, and system activity logs.

3.2. Performance Evaluation

System performance during testing was within acceptable operational parameters. Page load times remained within the five-second requirement under normal conditions. Real-time operations including room assignment updates, maintenance status changes, and message delivery were handled effectively with minimal latency. The modular architecture facilitated straightforward debugging and isolated module testing without disruption to other system

components. Database query response times for compatibility score computation and profile retrieval met the performance benchmarks established in the non-functional requirements.

3.3. Usability and User Acceptance

User acceptance testing revealed positive perceptions of the system's interface design and navigational clarity. Participants reported that the swipe-based matching mechanism reduced decision-making complexity compared to conventional list-based roommate selection methods [14]. The visual card-based profile presentation was found to be intuitive, consistent with findings that such interfaces are more effective among younger users when content is relatable and concise [14]. Students appreciated the real-time chat feature, which enabled coordination before final room allocation decisions. Administrators reported that the centralized dashboard significantly reduced the manual effort associated with tracking maintenance requests and managing room occupancy data.

3.4. Comparison with Related Systems

Compared to the three benchmark hostel management systems reviewed the Dormitory College Management System (DCMS), the Hostel Management System (HMS), and the E-Based Hostel Management System (e-HMS) UniMatch introduces several notable improvements. While all three benchmark systems focus on administrative automation of room allocation and financial tracking, none incorporates lifestyle-based compatibility profiling or a user-facing matching interface [22,23,24]. UniMatch addresses this gap directly by combining administrative efficiency with personalized student-facing features. Furthermore, UniMatch's real-time communication layer and categorized announcement system provide more structured information dissemination compared to the basic message boards implemented in the DCMS [25].

Relative to commercial roommate matching platforms such as Roomsurf and Diggz [13], UniMatch offers contextual restrictions absent from those systems: matching is confined to students within the same academic level at the same institution, reducing incompatibility arising from differing academic schedules and campus routines [16]. The integration of a swipe-based interaction model inspired by established engagement research [14] into a university housing context represents a novel contribution that differentiates UniMatch from both academic management systems and general housing platforms.

3.5. Alignment with the Theory of Planned Behavior

Observed user behaviors during acceptance testing were consistent with TPB predictions. Students who expressed positive beliefs about the system's ability to improve their living conditions (attitude) and who noted that peers and university staff had recommended the platform (subjective norms) demonstrated higher engagement with the matching features. Students who found the interface easy to navigate (high perceived behavioral control) proceeded further through the matching and room request workflows without requiring assistance. These patterns support the suitability of TPB as a framework for designing and evaluating student-facing residential technology [1,26,27].

4. Conclusion

This study presented the design, development, and evaluation of UniMatch, an improved web-based roommate matching and residential support system tailored for Nigerian university environments. The system successfully addresses core limitations of traditional housing management by integrating lifestyle-based compatibility profiling, a swipe-based matching interface, real-time student communication, maintenance request tracking, and centralized administrative management within a single platform.

The application of the Theory of Planned Behavior as the theoretical foundation informed both the design of the user experience and the interpretation of adoption behaviors observed during testing. Evaluation results demonstrate that UniMatch improves roommate compatibility outcomes, reduces administrative workload, and enhances communication between students and residential staff compared to conventional approaches. The system's modular architecture and incremental development approach support scalability and future feature integration.

Future research should focus on: expanding UniMatch to support multi-institutional deployment; incorporating machine learning algorithms to improve compatibility scoring accuracy; implementing longitudinal studies to assess the impact of compatibility matching on academic performance and student well-being; and strengthening data privacy and security mechanisms to ensure compliance with data protection standards.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no financial or non-financial conflicts of interest related to this research.

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