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3D Room Design Visualizer through Augmented Reality with Recommender System

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A B S T R A C T

The development of Augmented Reality (AR) and Artificial Intelligence (AI) has opened new ways to improve interior design. These technologies make it possible to give users interactive views and smart suggestions in real time. This study introduces a mobile system called "3D Room Design Visualizer through Augmented Reality with Recommender System." The system uses AR to show room layouts, AI to create design ideas, and Machine Learning (ML) to give furniture recommendations. Users can design and preview a room by placing virtual furniture, while the recommender suggests layouts and furniture based on the user's style, budget, and space. The system was tested by architects, interior designers, civil engineers, and homeowners. A 5-point Likert scale was used to measure functionality, usability, reliability, performance, and portability. The results showed an overall mean score of 4.34, which means most users were satisfied. The system was rated high in efficiency, performance, and adaptability. Reliability was rated a bit lower, but future improvements will focus on better stability and more personalized suggestions. This study shows that combining AR and AI can make room planning faster, easier, and more effective. The system provides a budget-friendly, user-friendly, and flexible tool for interior design. The results also suggest that this type of technology has strong potential to change how design is done by connecting creativity with practicality and modern tools.

Keywords: Augmented Reality, Artificial Intelligence, Recommender System, Interior Design, Machine Learning

1. Introduction

Interior design is important for improving both the look and function of spaces. Traditional methods are often slow, require a lot of work, and do not give real-time previews. New technologies like Augmented Reality (AR) and Artificial Intelligence (AI) can solve these problems by giving interactive previews and smart design suggestions. This study develops and tests a "3D Room Design Visualizer through AR with Recommender System" that helps users place furniture in real-time and get AI-based suggestions based on their style, room size, and budget. The goal of the study is to help users to arrange their room or rather decorate their room in the most budget-friendly way. Also, it gives the user a new experience in designing their room that makes them unique in their own way. With the advancement of technology, designing a room can help users to find the comfort, peace, and beauty that they need in everyday life. In line with this, More, Chavan, Shaikh, and Prof. Karthik (2021) stated that having this kind of system, users are now assisted in arranging furniture such as sofas, tables, paintings, etc. With this new kind of set-up, users can now use these tools to predict the design with the new look.

2. Materials and Methods

The system was developed as a mobile app using three main technologies such as Augmented Reality (AR) it shows furniture placement in real-time inside the user's actual room. Artificial Intelligence (AI) generates smart and practical room layouts and Machine Learning (ML) provides personalized furniture suggestions.

To ensure accuracy and relevance, a comprehensive dataset was utilized, consisting of room layouts, furniture dimensions, and various interior design styles. This dataset was used to train the system's recommendation engine, allowing it to improve suggestions over time. The application was carefully structured into modular components, with separate modules handling AR visualization, recommendation logic, and design management. This modular design not only makes the system more manageable and scalable but also ensures that each component can be upgraded independently as technology evolves. The researchers adopted the ISO 25010 software quality model, which measures essential attributes such as functionality, usability, reliability, performance efficiency, and portability. A survey instrument based on this standard was distributed to a diverse group of respondents, including

architects, civil engineers, interior designers, and homeowners. Using a 5-point Likert scale, respondents rated their experiences with the application. The mean scores for each criterion were carefully analyzed to assess system quality and overall user satisfaction.

3. Results

The evaluation results indicated strong system performance across all criteria. As shown in Table 1, the highest-rated aspect was Performance Efficiency (M = 4.5), followed by Functionality (M = 4.4), Usability and Portability (M = 4.3), and Reliability (M = 4.2). The overall mean score was 4.34, reflecting positive user feedback across professionals and homeowners.

Table 1. Mean Scores of System Evaluation per Criteria

Criteria	Mean Score
Functionality	4.4
Usability	4.3
Reliability	4.2
Performance Efficiency	4.5
Portability	4.3
Overall Mean	4.34

4. Discussion

The results show that the system met its goals by giving users a useful tool for room design and smart recommendations. High scores in performance efficiency prove that the app is fast and works in real-time. Functionality and usability ratings show that users found it helpful and easy to use for designing spaces. However, the lower score in reliability suggests that the system can still be improved, especially in stability and error handling. These results support earlier studies, like Revathy et al. (2024), which said AR and AI help connect imagination and reality in design, and Kán et al. (2020), which showed AR is strong in visualizing different design options.

5. Conclusion

This study concludes that the "3D Room Design Visualizer through Augmented Reality with Recommender System" is a practical, simple, and efficient tool for room design. With AR, AI, and ML working together, the system helps users be more creative, saves time, and makes better design decisions. Future improvements will focus on making the app more stable, adding support for more devices, and improving AI for more personalized suggestions. This will make the system even more useful for both professionals and homeowners.

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