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AI-Powered Interior Design Assistant: A Smart Approach to Personalized and Efficient Home Design

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Abstract- ***Interior design is no longer limited to manual planning and professional expertise, as technology has started playing an important role in making the process faster and more accessible. In this work, we present an AI-Powered Interior Design Assistant that helps users design their living spaces based on their preferences, room dimensions, and budget. The system is designed with multiple features including style and colour palette suggestions, furniture arrangement and optimization, and budget-conscious recommendations. In addition, a sustainability score is introduced to promote eco-friendly design choices. The proposed solution reduces the effort required in traditional design while giving users interactive and personalized results. By integrating artificial intelligence techniques such as recommendation systems and basic generative models, the assistant not only improves efficiency but also makes interior design accessible to individuals who may not have prior design experience. This project demonstrates how AI can be practically applied in the domain of interior design to achieve creativity, affordability, and user satisfaction. Overall, the system contributes towards bridging the gap between technical design knowledge and user imagination.***

Index Terms-- ***Artificial Intelligence, Interior Design, Recommendation System, Generative AI, Space Optimization, Sustainable Design.***

I. INTRODUCTION

Interior design is an important part of modern living, as it directly influences the comfort, functionality, and overall appearance of a space. Traditionally, interior design requires professional expertise, significant time, and a considerable budget. While design software tools exist, most of them demand prior technical knowledge and are not easily accessible to regular users. As a result, many people either depend entirely on professional designers or rely on trial-and-error methods, which can be both time-consuming and costly.

This project proposes an AI-Powered Interior Design Assistant that helps users create personalized room layouts and design recommendations based on their preferences, available space, and budget. Unlike existing tools, our system introduces unique features such as mood-based style recommendations, space optimization, budget-conscious suggestions, and sustainability scoring. The aim is to reduce manual effort while ensuring creativity, accessibility, and affordability in the design process.

By integrating AI into interior design, this work bridges the gap between technical expertise and user imagination. The proposed system not only supports professional designers in saving time but also empowers ordinary users to visualize and implement their design ideas more effectively.

II. LITERATURE SURVEY

Early interior design systems were mostly limited to CAD-based tools and visualization software, where the user had to manually select colours, furniture, and layouts. These tools improved drafting efficiency but lacked personalization and intelligent recommendations, making them less useful for non-experts.

With the rise of machine learning, researchers explored recommendation systems for home design. Content-based methods suggested furniture or palettes based on metadata, while collaborative systems learned from user preferences. Similarly, computer

vision approaches have been used to classify room styles and extract dominant colours from images, enabling semi-automated design suggestions. However, these systems often struggled with personalization and context-awareness.

Recent work has also introduced generative models and layout optimization techniques. Generative AI helps create visual mock-ups of interiors, while optimization algorithms attempt to arrange furniture efficiently within given room dimensions. Some studies have also considered sustainability, but integration of eco-friendly design into AI-based recommendations is still rare.

From the survey, it is clear that existing works address parts of the problem but rarely combine them into a single solution. There is a gap in developing a unified AI assistant that can handle mood-based personalization, budget-conscious design, space optimization, and sustainability scoring together. Our work aims to fill this gap by creating an end-to-end interior design assistant that balances creativity, efficiency, and practicality.

III. METHODOLOGY

Our project, *AI-Powered Interior Design Assistant*, follows a modular methodology where each step is designed to achieve a specific functionality. The system was developed with the aim of making interior design more personalized, affordable, and sustainable.

The major stages are as follows:

1. Data Collection

We created a dummy dataset of furniture, colours, and design styles to begin testing. The dataset includes details like furniture name, category, style, dimensions, cost, and material. For colours, weV. prepared palettes linked with moods such as *calm, energetic, cozy,* and *classic*.

2. Preprocessing

User inputs (room size, budget, mood, and style preference) are validated and normalized. The datasets are cleaned so that suggestions match the user's requirements without any conflict. Example: If a user selects "Cozy + Budget under ₹20,000," the system filters only matching furniture.

3. Style and Mood Recommender

This module maps mood and style preferences to suitable colour palettes and furniture sets. Example: *Calm mood → light wall shades + minimal furniture*. Implemented initially with rule-based logic, later enhanced using simple recommendation techniques.

4. Space Optimization

Based on room dimensions, the system suggests possible furniture arrangements. A grid-based layout planner was created to ensure proper spacing, walkway clearance, and usability. This feature helps in maximizing either space usage or comfort, depending on user preference.

5. Budget Optimizer

User sets a budget range, and the system filters furniture and décor suggestions accordingly. The optimizer ensures that the design remains practical and affordable while maintaining aesthetics.

6. Sustainability Scoring

Each design recommendation is given a sustainability score based on materials and energy efficiency. For example, wooden furniture and light-coloured walls score higher than plastic materials and darker tones. This makes users more aware of eco-friendly choices in interior design.

7. Visualization

For better user experience, the system provides design mock-ups (2D/3D previews). Initially, static layouts are generated; later, generative AI models can be integrated for more realistic room images.

IV. EXISTING SYSTEM

Most of the existing interior design tools are limited to CAD software and 3D modelling applications such as AutoCAD, SketchUp, or Planner5D. These tools mainly focus on providing a platform for designers to draw layouts, place furniture, and visualize spaces in 2D or 3D. While they are powerful, they require professional knowledge and are not very beginner-friendly. Normal users without design experience find it difficult to use these tools effectively.

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Some mobile and web applications also exist that allow users to try different colour palettes and furniture styles, but they are usually static in nature. They do not consider important factors like room dimensions, budget constraints, or sustainability. For example, many apps can suggest wall colours but will not ensure whether the selected furniture fits within the given space or whether the overall cost is affordable.

A few AI-based attempts have been made in recent years, mostly focusing on style recognition or automatic visualization. However, these systems usually concentrate only on one aspect, such as recommending furniture based on style, or generating a design image, without integrating other practical needs like cost-effectiveness, eco-friendliness, or mood-based personalization.

Thus, the limitation of existing systems is that they either require expert knowledge or lack the ability to give end-to-end design assistance. This leaves a gap for a solution that can combine automation, personalization, and real-world practicality into a single intelligent assistant.

VI. PROPOSED SYSTEM

To overcome the limitations of existing design tools, we propose an AI-Powered Interior Design Assistant that is simple, interactive, and practical for both professionals and normal users. The system combines multiple intelligent modules into a single platform, ensuring that design is not only creative but also affordable and eco-friendly.

The key features of our proposed system are:

1. Mood-Based Design

The system takes the user's mood or theme preference (such as calm, energetic, cozy, or classic) and suggests matching colour palettes and furniture styles. This personalization makes the design feel more connected to the user's emotions and lifestyle.

2. Space Optimization

Based on the room dimensions, the assistant recommends a proper furniture arrangement. A grid-based placement algorithm ensures efficient use of space while maintaining walkways and comfort. This helps small rooms look spacious and large rooms more balanced.

3. Budget Optimizer

Users can set a budget range, and the system filters suggestions to stay within that amount. This feature ensures that the designs are practical and can be implemented without overspending.

4. Sustainability Score

Every recommendation comes with a sustainability score based on material choice, natural light usage, and energy-efficient layouts. This motivates users to choose eco-friendly designs and make responsible choices.

5. Visualization

The assistant provides visual outputs of the room layout and suggested colours /furniture. At the basic level, this includes simple 2D layouts; in the advanced stage, generative AI models can be used to create realistic 3D previews.

VII. CONCLUSION

The AI-Powered Interior Design Assistant developed by our team shows how artificial intelligence can make interior design more personalized, efficient, and user-friendly. By combining features like mood-based style recommendations, space optimization, budget management, sustainability scoring, and visualization, the system addresses several gaps present in existing tools.

This project not only helps professional designers save time but also enables normal users with little or no design knowledge to create practical and creative interiors. Our work demonstrates that with the right integration of AI, interior design can become more accessible, affordable, and environmentally responsible.

In the future, the system can be enhanced by adding Augmented Reality (AR) or Virtual Reality (VR) for immersive previews, and by training on larger datasets for more accurate and diverse recommendations. Overall, the project highlights the potential of AI in

bridging the gap between technical expertise and user imagination in the field of interior design.

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