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# Survey on Decovision : Redefine your space with smart decor

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## Abstract

This survey introduces Decovision, a smart and modular interior design platform that uses AI, machine learning, and web technologies to offer a personalized home decor experience. It integrates real-time room visualization via Stability AI's image generation API, a style recommendation engine based on a user quiz, and a furniture chatbot that filters IKEA products using natural language queries. Built with Flask and SQLite, the platform emphasizes accessibility and cost-efficiency through open-source tools. Decovision's scalable architecture supports a human-centered design approach, helping users transform preferences into actionable design outputs regardless of expertise. This survey highlights the system's potential to simplify and democratize interior styling through intuitive AI-driven interactions.

**Keywords:** AI In Interior Design; Stability AI; Style Recommendation Engine; Flask; Sqlite; NLP; User-Centered Design; Furniture Chatbot; Home Décor; Image Generation

## 1. Introduction

Interior decoration is a subjective and creative process that often lacks affordability, guidance, and accessibility for everyday users. With the rise of e-commerce and AI, there is an opportunity to democratize design by combining data, preferences, and generative tools.

Emerging AI capabilities offer the potential to enhance personalization and simplify decision-making in interior design. The increasing availability of visual generation models, structured data sources like product inventories, and accessible web technologies creates the ideal setting for a system that bridges creativity with computation. Our motivation lies in creating a cohesive, user-centered application that lowers barriers to entry while providing high-quality design support.

Stability AI helps users visualize and build room aesthetics by identifying suitable hues from inspiration images, thus aligning design suggestions with their visual preferences. It adds an extra layer of personalization to the overall user experience.

The integration of artificial intelligence into interior design enables new forms of customization, creativity, and user accessibility. The shift from traditional static design tools to intelligent systems reflects the growing need for personalized and dynamic experiences. This paper introduces Decovision, an AI-powered modular design system that bridges user's

stylistic preferences with machine-generated design outputs. It emphasizes user empowerment by allowing everyday individuals to engage in the design process through accessible tools like quizzes, chatbots, and visual transformations. The objective is to build a scalable and cost-effective solution that supports creativity, functionality, and real-world usability.

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## 2. Literature review

### 2.1. Visually Compatible Home Décor Recommendations - Zhang et al. (2022)

This study presents a system that leverages AI to match furniture and accessories with existing room aesthetics based on visual compatibility and style preferences.

Methodologies Used: Convolutional Neural Networks (CNNs) for visual analysis and matching room aesthetics with furniture design.

### 2.2. Personalized Interiors at Scale - Zhou & Wang (2024)

The paper discusses scaling personalized interior design recommendations by analyzing user interaction and preferences.

Methodologies Used: Data analytics and user behavior analysis to provide personalized recommendations based on large datasets.

### 2.3. Home Décor Recommendations Using Collaborative Filtering - Choi et al. (2023)

This research explores using collaborative filtering algorithms to recommend home décor based on user behavior and preferences.

Methodologies Used: Collaborative Filtering, which identifies user preferences and suggests décor based on similar behaviors from other users.

### 2.4. Interactive Interior Design Recommendation System (IIDRS) - Zhang et al. (2024)

This system integrates user preferences with AI to generate personalized room layouts and décor suggestions through interactive inputs like room type and budget.

Methodologies Used: AI-based design integration, using structured user input data for generating personalized room layouts.

### 2.5. Deep Learning-Based Home Décor Recommendation System - Li et al. (2023).

This paper proposes a deep learning system for recommending furniture and décor, utilizing user data and context-aware features.

Methodologies Used: Deep Learning, User Behavior Data Analytics, Context-Aware Filtering.

### 2.6. AI-Driven Personalized Design for Home Interiors - Wang et al. (2023)

This research focuses on generating personalized home décor styles using AI and design analysis based on user input and preferences.

Methodologies Used: AI algorithms, preference analysis, and neural network-based style generation.

### 2.7. Home Decoration with Generative Design Models - Chen et al. (2023).

The study discusses how generative design models can be used to assist in home decoration by creating personalized layouts and recommendations based on user specifications.

Methodologies Used: Generative Design Models, NeuralNetworks for personalized recommendations, and style generation.

### 2.8. Home Interior Design Using NLP and AI - Patel etal. (2024).

The paper introduces a natural language processing-based interface to interact with users and suggest home décor, focusing on personalization.

Methodologies Used: Natural Language Processing (NLP), User Query Understanding, AI for Recommendation Systems.

### 2.9. Real-time Personalized Home Décor System - Liu et al. (2024)

This work presents a real-time system that offers personalized home décor recommendations based on dynamic user inputs and design preferences.

Methodologies Used: Real-Time Data Analytics, Dynamic User Preferences, AI-based Room Design Assistance.

### 2.10. AI-Based Intelligent Home Décor System Lee et al. (2023).

This system focuses on AI-driven analysis of user's rooms to suggest optimal furniture placements and décor combinations.

Methodologies Used: AI, Deep Learning Algorithms, Room Analysis for décor suggestions.

## 3. Objectives

This project aims to build an AI-powered interior design platform that offers users the ability to upload or describe their rooms and receive visually enhanced redesigns generated through Stable Diffusion. It will include an interactive style identification quiz that connects user preferences to specific interior design styles using a structured dataset. The platform will also extract color palettes from room images by applying OpenCV and clustering algorithms such as KMeans. Personalized furniture and decor recommendations will be provided based on the user's design style and budget, using NLP-driven filtering and real-time product data. All components including image transformation, style quiz, color palette generation, and furniture planning will be seamlessly integrated into a responsive web interface developed with React and Flask. User data and quiz outcomes will be efficiently managed using SQLite or Pandas-based logic to support ongoing personalization. Ultimately, the platform aims to deliver a fully automated and tailored design experience,

## 4. Architecture

The AI-powered interior design platform is structured to provide a smooth and intelligent user experience by combining user input, smart processing, and real-time data. Users upload images or describe their rooms via an interface, which triggers the core system to process the input.

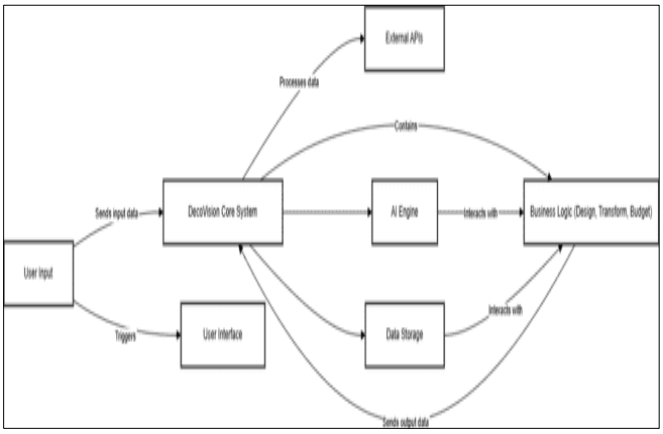


Figure 1 System architecture

### 4.1. Decovision AI system architecture for personalized home décor recommendations.

The AI engine then performs tasks like style detection, room redesign, and personalized recommendations, working alongside the business logic that handles design, transformation, and budget alignment. External APIs provide real-time product data, while the data storage module retains user inputs and results for personalization. Final outputs are delivered through the interface, offering tailored and visually enhanced design suggestions.

## 5. Experimental Results and Performance Comparison

This section compares recent image generation models, focusing on their real-time rendering speed and key visual features like image sharpness, stylistic accuracy, and user approval. The goal is to assess how well each model balances fast processing with high visual fidelity, which is essential for smooth user interactions in interior design platforms. This comparison provides insights into the strengths and limitations of models used for AI-based room redesign tasks.

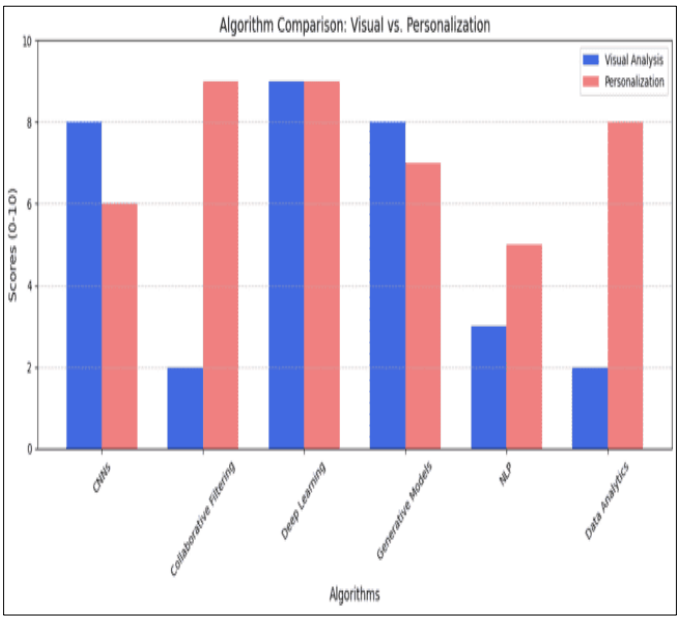


Figure 2 Performance Comparison

### *5.1.* Algorithm Comparison: Visual vs. Personalization

The bar chart "Algorithm Comparison: Visual vs. Personalization" compares six algorithms—CNNs, Collaborative Filtering, Deep Learning, Generative Models, NLP, and Data Analytics—on visual analysis and personalization (0–10 scale). Deep Learning scores highest and most balanced in both, making it the most versatile. CNNs excel in visual analysis but lag in personalization, while Collaborative Filtering and Data Analytics show the opposite trend, prioritizing personalization over visuals. Generative Models perform well in both, though slightly below Deep Learning. NLP scores lowest overall. The chart suggests combining Deep Learning **and**Generative Models for systems needing both visual and personalized recommendations, with Collaborative Filtering and Data Analytics as supporting personalization tools.

**Table 1** Comparison table

| S.No | Title & Author | Focus Area | Methodologies Used | Contributions | Limitations |
|---|---|---|---|---|---|
| 1 | Visually Compatible Home Décor Recommendations Zhang et al. (2022) | Matching furniture & accessories with room aesthetics based on visual compatibility | CNNs for visual analysis | Achieved style-matching between existing décor and new items visually | Limited to static images; struggles with dynamic environments |
| 2 | Personalized Interiors at Scale Zhou & Wang (2024) | Scaling personalized interior design via user interaction analysis | Data Analytics, User Behavior Analysis | Scaled recommendations to large datasets, enabling personalization at scale | Lacks visual analysis; mainly behavior-driven without aesthetic validation |

| | | | | | |
|---|---|---|---|---|---|
| 3 | Home Décor Recommendations Using Collaborative Filtering Choi et al. (2023) | Recommending décor based on similar user behavior | Collaborative Filtering | Leveraged user similarities for better personalization | Cold-start problem; poor performance for new users without history |
| 4 | Interactive Interior Design Recommendation System (IIDRS)Zhang et al. (2024) | Personalized layouts & décor via interactive inputs | AI-based design integration, Structured User Input | Enabled users to specify budget, room type for tailored recommendations | Limited automation; relies heavily on structured input |
| 5 | Deep Learning-Based Home Décor Recommendation System Li et al. (2023) | Recommendations using user data & contextual factors | Deep Learning, User Data Analytics, Context-Aware Filtering | Incorporated contextual awareness for more relevant suggestions | Requires large labeled datasets; scalability issues |
| 6 | AI-Driven Personalized Design for Home Interiors Wang et al. (2023) | Generating personalized décor styles with AI & design analysis | AI Algorithms, Preference Analysis, Neural Networks | Combined user preferences with neural style generation for unique designs | Lacks real-time adaptability; focused on static recommendations |
| 7 | Home Decoration with Generative Design Models Chen et al. (2023) | Personalized layouts & décor using generative models | Generative Design Models, Neural Networks | Enabled automatic design generation based on user specs | May generate impractical or unrealistic designs; needs human validation |
| 8 | Home Interior Design Using NLP and AI Patel et al. (2024) | Personalized décor recommendations via NLP-based interaction | NLP, User Query Understanding, AI Recommendations | Allowed users to interact naturally via language for recommendations | Limited understanding of complex queries; language ambiguity issues |
| 9 | Real-time Personalized Home Décor System Liu et al. (2024) | Real-time recommendations based on dynamic user input | Real-Time Data Analytics, Dynamic Preferences, AI Design | Enabled adaptive recommendations as preferences change in real-time | Computationally intensive; challenges in latency & processing |
| 10 | AI-Based Intelligent Home Décor System Lee et al. (2023) | Suggesting optimal furniture placement & décor via room analysis | AI, Deep Learning, Room Analysis | Focused on space optimization & functional placement | Visual output may lack aesthetic appeal; depends on room photo quality |

## 6. Conclusion

The analysis of AI-powered home decor recommendation system reveals significant advancements and persistent challenges in the field. Decovision successfully demonstrates how artificial intelligence can revolutionize interior design by making it more accessible, personalized, and interactive. By integrating Stability AI's image generation models, a custom style quiz, and real-time IKEA product recommendations, the system offers a seamless design experience from inspiration to implementation. Users can visualize room transformations, discover their design preferences, and explore matching products within their budget. The combination of text-to-image synthesis, user-driven input, and e-commerce integration makes DecoVision a unique and practical solution for modern interior design challenges. However, issues such as dataset limitations, visual compatibility, and the need for dynamic, adaptive adjustments to user preferences

and environmental factors still exist. To address these challenges, future research should focus on multimodal AI models that incorporate behavioral and contextual data for more personalized recommendations. By addressing these gaps, Decovision and similar AI systems have the potential to set new standards for personalized, efficient, and accessible interior design. To improve and scale the DecoVision system further, the following enhancements are proposed.

## Compliance with ethical standards

*Disclosure of conflict of interest*

The authors declare that there is no conflict of interest.

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