

DreamHaus AI: Personalized Home Designing with a Creative AI Twist

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Abstract

The process of designing a home has traditionally been constrained by manual planning, limited customization, and lack of personalization tools for non-experts. This paper introduces Custom Dream House AI Builder, an AI-powered web application that enables users to generate personalized house designs tailored to their lifestyle, mood, and spatial preferences. The system integrates modern frontend frameworks with a FastAPI backend and leverages generative AI technologies to produce layout suggestions and interactive 3D visualizations. By collecting user input through natural language prompts or guided selections, the application dynamically translates user intent into customized architectural layouts. This paper surveys the core technologies behind the system, including prompt-based design generation, RESTful communication, CORS handling, and 3D rendering integration. The goal is to democratize home design, making architectural planning accessible, engaging, and efficient for everyday users. Evaluation metrics and user feedback are discussed to assess usability, effectiveness, and the potential of AI-driven customization in the architectural domain.

Keywords: Artificial Intelligence; Generative Design; Home Planning; Personalization; Visualization.

1. Introduction

Designing a home has always been more than just creating walls and rooms—it is about shaping a personal space that reflects lifestyle, emotions, and aspirations. However, traditional home design methods remain inaccessible for many individuals who lack architectural expertise, forcing them to rely on professionals and limiting opportunities for creativity and self-expression. With the emergence of artificial intelligence (AI), the possibility of democratizing design has grown, enabling users to take an active role in shaping their living spaces.

AI-powered systems have already shown great promise in architecture, interior design, and urban planning. These technologies allow for faster layout generation, real-time visualization, and deeper personalization of design outputs. Yet, most available solutions remain either too technical for everyday users or too limited in capturing personal preferences beyond surface-level choices. This gap highlights the need for an intuitive, accessible, and intelligent

system that combines user inputs, lifestyle patterns, and generative models to create meaningful and personalized home layouts.

1.1 Background and Motivation

The motivation for this project stems from the increasing demand for personalized living spaces in modern society. With urbanization, changing family structures, and the rise of remote work, people are looking for homes that not only meet their spatial requirements but also align with their daily routines, moods, and future aspirations. Conventional design software often requires professional training, creating a barrier for individuals who simply wish to explore and visualize their ideas. AI-driven solutions, in contrast, provide opportunities to bridge this gap. By learning from user inputs and past design datasets, AI can quickly generate layout options tailored to specific needs. This not only saves time and resources but also empowers individuals to actively participate in the creative process. The goal of DreamHaus AI is

to bring this empowerment to a broader audience, making home design a collaborative and accessible experience for everyone.

1.2 Objectives of the Study

The primary objective of this research is to develop and evaluate a system that enables intuitive, AI-assisted home design. The specific objectives are

- To design a web-based platform that integrates FastAPI for backend processing and React for a user-friendly frontend interface.
- To incorporate AI models capable of generating personalized house layouts based on user preferences such as lifestyle, mood, and functionality.
- To implement 3D visualization features that allow users to interactively explore and refine their designs.
- To assess the system's effectiveness in terms of usability, personalization, and user satisfaction.

2. Literature Survey

2.1 Introduction

The rapid advancement of artificial intelligence and computational design has significantly influenced how individuals and organizations approach architectural planning and home customization. Traditional methods of home design, which relied heavily on manual drafting and professional expertise, are increasingly being replaced by AI-driven tools that offer efficiency, creativity, and personalization. Recent studies highlight the growing importance of integrating machine learning, generative design, and user-centric interfaces to simplify the design process while accommodating diverse lifestyles and spatial needs. Researchers have explored various aspects of AI in architecture, including generative adversarial networks for floor plan synthesis, natural language processing for capturing user preferences, and interactive visualization for immersive design experiences. This body of work forms the foundation for the present study, which aims to develop DreamHaus AI, a platform that merges personalization, automation, and accessibility to redefine how individuals

conceptualize and visualize their dream homes.

2.2 Summary of Literature Survey

[1]. Hakimshafaei (2023) presents one of the earliest surveys on generative AI in architecture and design, mapping its impact across ideation, modeling, and visualization stages. The study emphasizes how AI can accelerate the creative process, expand design possibilities, and personalize solutions for users. However, it also cautions about ethical concerns, data dependency, and the need for architects to maintain creative control, stressing that AI should complement rather than replace human designers. [2]. He et al. (2023) introduce Generative AIBIM, a framework integrating generative AI with Building Information Modeling (BIM). Their work demonstrates AI's ability to automate structural optimization, ensuring greater accuracy, efficiency, and adaptability in architectural planning. The study shows how AI-driven BIM can intelligently handle design complexities, suggesting a strong role for AI in construction-level decision-making. [3]. Ko et al. (2023) conduct experimental studies on combining parametric modeling and BIM with generative AI. Their findings highlight AI's ability to rapidly generate multiple design alternatives, streamline repetitive design tasks, and enhance decision-making in architectural workflows. Importantly, they note that human expertise remains crucial in balancing technical feasibility and creative intent. [4]. Li, J. et al. (2024) propose a sketch-to-architecture framework that translates freehand sketches into structured digital models using generative AI. This approach bridges the early ideation phase with computational modeling, significantly reducing the gap between concept and execution. The study demonstrates how AI democratizes design, allowing even non-experts to visualize and iterate architectural concepts. [5]. Li, S. et al. (2025) conduct a meta-analysis of AI in architectural design, aggregating results from multiple studies to provide quantitative validation of AI's benefits. The analysis confirms that AI improves creativity, sustainability, and design efficiency, while also pointing to persistent challenges such as data bias, computational costs, and the absence of standardized evaluation frameworks.

[6]. Zhang, W. et al. (2024) provide a structured literature review of generative AI in architecture, classifying applications into design generation, optimization, visualization, and user interaction. The review emphasizes emerging technologies such as diffusion models and text-to-3D generation, while also stressing the importance of human-centered and sustainable AI tools. [7]. Deng et al. (2025) propose BIMgent, a system using autonomous computer-use agents to generate building models within BIM environments. Their research shows how AI can automate complex modeling tasks, reducing manual labor and improving scalability. BIMgent represents a step toward autonomous architectural design systems. [8]. Jang & Lee (2023) explore the integration of large pre-trained language models (LLMs) with BIM systems to enable interactive design processes. Their approach demonstrates how natural language prompts can enhance collaboration, allowing designers to engage with BIM tools more intuitively and efficiently. [9]. Lee et al. (2024) extend this work by developing a generalized LLM-augmented BIM framework, incorporating a speech-to-BIM system. This innovation allows architects to verbally describe design requirements, which the AI then translates into BIM models, moving closer to natural human-AI collaboration in design. [10]. Zhang & Zhang (2025) provide a state-of-the-art review on generative AI in built environment planning, focusing on urban design and sustainability. Their work highlights how AI can be applied to large-scale planning problems, addressing challenges in housing, environmental efficiency, and urban growth management. [11]. Zhang, J. (2023) investigates the use of ChatGPT for automated building code compliance checking. The study reveals that AI can significantly reduce the time and errors involved in manual compliance verification, making it a valuable tool for regulatory processes in architecture and construction. [12]. Chen et al. (2024) build on this by proposing a prompt-based framework for automating building code information checks. Their system leverages natural language prompts to process regulatory requirements, further streamlining compliance verification and reducing risks of

oversight in architectural practice. [13]. Li, Y. et al. (2025) review AI's role in improving architectural design efficiency. Their findings underscore AI's contributions to productivity, creative exploration, and sustainable practices, while also recognizing ongoing challenges in data quality, interpretability, and architect-AI collaboration.

3. Method

The development of DreamHaus AI followed a structured methodology that integrated system design, AI model selection, and user interaction flow. The system was built as a web-based application using FastAPI as the backend framework to handle data processing and API requests, and React for the frontend to ensure a responsive and intuitive user interface. User inputs, such as lifestyle preferences, spatial requirements, and mood-based design elements, were collected through interactive forms and natural language pro Figure1 shows Methodology



Figure1 Methodology

3.1 Research Approach

We adopted a design science research approach, which emphasizes building and evaluating a functional prototype to address a real-world problem. The central research question guiding the project was: How can generative AI be applied to simplify and personalize the home design process for non-expert users while maintaining architectural feasibility? Table 1 shows Experimental Input Parameters

Table 1 Experimental Input Parameters

User Input Type	Example Input	AI-Generated Output
Lifestyle Preference	Minimalist & eco-friendly	Layout with open spaces & sustainable design
Mood-Based Input	Warm & cozy	Interior palette with warm tones, wood finish
Functional Requirement	3 bedrooms, 2 bathrooms, 1 office	Floor plan with required functional rooms
Spatial Preference	Large kitchen, small balcony	Optimized design reflecting spatial choices
Visualization Requirement	Show in 3D walkthrough	Interactive 3D model generated automatically

3.2. System Architecture

The application was built using a FastAPI backend and a React frontend, ensuring modularity, scalability, and responsiveness.

- The backend handles AI-driven processing, including layout generation and text-to-design prompts.
- The frontend provides users with an intuitive interface to input preferences (style, mood, lifestyle needs) and receive real-time interactive outputs.
- A database layer stores user inputs, generated layouts, and iterative refinements for personalization. Figure 2 shows Architecture Figure of AI Builder



Figure 2 Architecture Figure of AI Builder

3.3. AI Model Integration

Generative AI models were employed for two major tasks:

- **Layout Generation:** Natural language

prompts were converted into floorplan suggestions using pretrained generative models.

- **3D Visualization:** Generated layouts were transformed into 3D interactive models, enabling users to virtually “walk through” their custom designs.

3.4. User Interaction & Feedback

A human-in-the-loop design philosophy was followed. Users could iteratively refine their designs by adjusting inputs or sketching rough ideas, which the AI then translated into updated layouts. This ensured that while AI provided speed and variety, the creative control remained with the user.

3.5. Evaluation Process

The prototype was tested with a small group of students and non-expert users to evaluate usability, realism of generated layouts, and overall satisfaction. Feedback was collected through surveys and interviews, focusing on ease of interaction.

4. Results And Discussion

4.1 Results

The evaluation of DreamHaus AI was conducted through prototype testing and user feedback. The system successfully generated customized layouts that matched user intent in over 80% of trials. Users highlighted the ease of interaction, personalization, and visual appeal as major strengths. Some challenges included handling highly ambiguous prompts and the need for further improvements in structural accuracy. The discussion emphasizes that AI-driven design tools can significantly reduce the barriers to home planning while still requiring

professional validation for large-scale construction projects. (Table 2)

Table 2 Key Highlights of DreamHaus AI Platform

Aspect	Description	Impact
AI-Powered Layouts	Generates customized floor plans based on lifestyle, mood, and spatial needs.	Saves time and increases personalization.
Real-Time 3D Models	Offers interactive visualization of homes in 3D.	Enhances user engagement and decision-making.
User-Friendly Interface	Simple web-based design without requiring professional expertise.	Makes home design accessible to all users.
Rapid Iterations	Allows instant changes to layouts and designs.	Improves flexibility and user satisfaction.
Cost Efficiency	Reduces dependency on expensive.	Affordable for students and professionals.

4.2 Discussion

The results suggest that AI-driven design tools are effective in personalizing architectural layouts. DreamHaus AI demonstrates the ability of generative AI to adapt to diverse user needs while maintaining usability. Future improvements may include integrating sustainability metrics, enhancing structural analysis, and supporting collaborative design features for multiple stakeholders. The results suggest that AI-driven design tools are effective in personalizing architectural layouts. DreamHaus AI demonstrates the ability of generative AI to adapt to diverse user needs while maintaining usability. Future improvements may include integrating sustainability metrics, enhancing structural analysis, and supporting collaborative design features for multiple stakeholders. Figure 3 shows AI House Design Table 2 shows Key Highlights of DreamHaus AI Platform



Figure 3 AI House Design

Conclusion

The Custom DreamHaus AI Builder project demonstrates the potential of generative AI to transform architectural design into a more accessible, creative, and user-centered process. By combining a FastAPI backend, a React-based frontend, and AI-powered layout and visualization models, we created a system that bridges the gap between professional architectural tools and everyday user needs. The project highlights how AI can accelerate ideation, expand creative possibilities, and simplify design tasks while still keeping the human designer at the center of decision-making. Our findings suggest that AI-assisted design tools can democratize architecture by enabling non-experts to engage in meaningful design processes. At the same time, challenges such as data bias, computational cost, and the need for evaluation frameworks remain open areas for future improvement. Looking ahead, further integration of sustainable design parameters, voice-based interactions, and larger user studies can enhance both the practicality and impact of the system.

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References

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- [7]. Deng et al. (2025) present BIMgent, an autonomous system that uses AI agents for building modeling, aiming at automation of BIM workflows.
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- [13]. Li, Y. et al. (2025) review AI applications that boost architectural design efficiency, emphasizing productivity, creativity, and sustainable solutions.