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AI-Based Approach using Generative Adversarial Network for Interior Design System

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Abstract

This research paper presents an AI-based interior design system utilizing Generative adversarial Networks (GANs) for realistic textual content-to-image conversion, incorporating room dimensions and user preferences. The system leverages Black forest Labs' FLUX.1 (schnell) model, a highpace, open-source variant optimized for rapid and high constancy image generation. by inputting textual descriptions and spatial constraints, the model generates customized interior layout visualizations, enabling architects, designers, and homeowners to explore diverse layouts, fixtures arrangements, and aesthetics in actual-time. The proposed approach complements the performance of layout workflows by way of providing AI-driven innovative assistance, decreasing guide effort, and presenting photorealistic previews tailor-made to person specifications. This examine evaluates the device's effectiveness in producing coherent, high-quality interior designs and discusses potential applications in architecture, real estate, and virtual staging.

INTRODUCTION

Interior design is a important factor of architecture, influencing aesthetics, functionality, and person experience. traditionally, the layout technique requires extensive guide effort, involving conceptual sketches, 3-d modeling, and iterative refinements. however, recent advancements in artificial Intelligence (AI) and Generative adversarial Networks (GANs) have opened new opportunities for automating and enhancing the interior layout process. This paper introduces an AI-primarily based interior design system that leverages text-to-image generation to create customized design visualizations based on room dimensions and user descriptions. The proposed system makes use of Black forest Labs' FLUX.1 (schnell) model, an optimized, high-speed diffusion-based AI model designed for efficient and high-quality image generation. by integrating GAN-based text-to-image translation with structured spatial inputs, the machine generates realistic indoors layouts, fixtures preparations, and ornamental elements tailor-made to consumer specifications. This method drastically reduces the time and effort required for conceptualization, allowing designers, architects, and homeowners to visualise interior spaces dynamically.

This research explores the effectiveness of the machine in generating coherent, high-resolution interior designs, assesses its realistic applications in structure and real estate, discusses ability improvements. The look at goals to bridge the distance between AI-driven

automation and human creativity, paving the manner for intelligent, user-friendly layout tools that enhance decision-making and innovation in the interior design industry.

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SYSTEM MODEL AND ASSUPTIONS

In this interior design project, the system modeling is built around the Black Forest Labs' Flux SCNHELL model, which serves as the core engine for spatial analysis and layout generation. The system takes room dimensions as primary input—length, width, and height—alongside additional parameters such as wall orientation, window and door placements, lighting conditions, and desired design style (e.g., modern, rustic, minimalist). The Flux SCNHELL model interprets these parameters to generate a spatial map and determine the optimal arrangement of furniture and décor. The model's advanced spatial reasoning enables it to work within architectural constraints while maintaining a balance between functionality and aesthetics. The key assumptions of this system include the idea that room geometry and design preferences can be effectively translated into numerical or categorical data suitable for processing by the Flux SCNHELL model. It assumes a semi-structured input format where users provide room measurements and design intent through predefined options or guided forms. Additionally, the system presumes that the core design logic—such as symmetry, flow, and color harmony—can be abstracted and replicated algorithmically. This assumption allows the use of GANs (Generative Adversarial Networks) to enhance visual realism and offer diverse design options by generating multiple room variants, which are then evaluated and refined through a discriminator model to ensure spatial and stylistic accuracy.

To make the process user-friendly and interactive, the system can be extended with an intuitive UI (e.g., using Gradio), but even in a model-focused setup, the interaction is structured and repeatable. The system relies on a feedback loop between user input and GAN output—users adjust inputs (dimensions, furniture preferences, material palettes), and the system regenerates interior design proposals accordingly. This approach assumes that users can judge and select from AI-generated options, and that the generative model, guided by both spatial rules from Flux SCNHELL and creative outputs from GANs, will converge on a solution that matches both the practical needs and stylistic goals of the user.

EFFICIENT COMMUNICATION

Efficient communication in an interior design project using the Black Forest Labs' Flux SCNHELL model centers on a clear, structured exchange of design-related parameters between the user and the AI system. The model functions as the core engine, interpreting inputs such as room dimensions, room type (e.g., bedroom, kitchen), architectural style (e.g., Scandinavian, industrial), wall color, flooring material, furniture preferences, and lighting specifications. Communication is streamlined through parameter-driven forms or user interfaces that standardize how information is collected, minimizing ambiguity and enabling accurate spatial and aesthetic interpretation. The system also benefits from visual aids—like reference images or swatches—which help refine style preferences and align the AI's output with the user's vision.

This approach assumes that users can effectively express their needs through structured categories and measurable inputs, which the Flux SCNHELL model converts into a semantic understanding of the space. By dynamically adapting to changes in parameters (e.g., altering wall color impacts lighting choices), the model maintains cohesive design logic. A responsive, interactive interface—such as one built with Gradio—supports an iterative workflow where users receive real-time design suggestions, provide feedback, and fine-tune their preferences. This two-way communication loop closely simulates a human consultation process, allowing for a personalized and efficient interior design experience that evolves with user input

SECURITY

Security in an interior design project using the Black Forest Labs' Flux SCNHELL model, with inputs like room dimensions and various design parameters, is critical to protect user data, design integrity, and AI-generated intellectual property. Since the system collects sensitive spatial data—such as room layouts, architectural features, and personal preferences—robust data encryption and secure data transmission protocols (e.g., HTTPS, SSL/TLS) must be implemented to ensure all user inputs are safeguarded during upload and processing. Rolebased access controls should also be applied to prevent unauthorized access to stored data or AI-generated designs, especially in shared or collaborative environments.

Additionally, the use of GANs (Generative Adversarial Networks) for generating interior

design variations introduces the need for integrity validation. As GANs create unique, high-fidelity design outputs, model output protection becomes essential to avoid data leaks or misuse of proprietary designs. This includes watermarking generated images, restricting download permissions, and employing AI output verification to ensure the authenticity of results. Moreover, to avoid adversarial attacks or manipulation of the design generation pipeline, the system should implement input validation and sanitization techniques, ensuring only trusted and formatted data reaches the model.

From a broader perspective, ethical AI use and user consent are central to security. Users must be informed about how their data will be used, stored, and potentially reused for model training or improvement. An opt-in framework can be introduced for users who allow anonymized design data to enhance the GAN and Flux SCNHELL models. By combining cybersecurity best practices with responsible AI governance, the interior design system can maintain a secure and trustworthy environment for creative collaboration.

RESULT AND DISCUSSION

Below figures will show the different layouts for different room types by giving there dimensions (length and breadth)

Room Length: 12, Room Breadth: 10, Room Type: Bedroom, Primary Adjective: Luxurious, Architectural Style: Modern, Primary Colour: Grey, Wood Finish: Pine, Wall Colour: White, Tile Type: Marble

Figure 1: Bedroom Interior Layout

Room Length: 12, Room Breadth: 12, Room Type: Living Room, Primary Adjective: Traditional, Architectural Style: Modern, Primary Colour: Biege, Wood Finish: Oak, Wall Colour: Light Grey, Tile Type: Granite

Figure 2: Living Area Layout

Room Length: 12, Room Breadth: 10, Room Type: Office, Primary Adjective: Cozy, Architectural Style: Modern, Primary Colour: White, Wood Finish: Walnut, Wall Colour: Dark Blue, Tile Type: Ceramic

Figure 3: Office Interior Design

Room Length: 12, Room Breadth: 15, Room Type: Kitchen, Primary Adjective: Traditional, Architectural Style: Classical, Primary Colour: Blue, Wood Finish: Mahogany, Wall Colour: White, Tile Type: Wooden

Figure 4: Kitchen Interior Design

CONCLUSION

The integration of Conditional Generative adversarial Networks (cGANs) with Black forest Labs FLUX.1 (schnell) in an AI-based interior

design system marks a significant advancement in automatic design generation, offering particularly realistic, spatially accurate, and customizable interior layouts based on text descriptions and room dimensions. This research highlights the efficacy of AI in streamlining interior design workflows, decreasing manual attempt while enhancing creative possibilities for architects, designers, and actual estate experts. by way of incorporating interactive refinements, real-time visualization, and capability destiny improvements which includes 3D rendering, AR integration, and smart home connectivity, the proposed device paves the way for a extra accessible, intelligent, and efficient method to interior layout. As AI technology continue to evolve, this study establishes a foundation for future innovations, ensuring that AI-driven interior design systems become more adaptive, useful, and immersive in the coming years.

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