



Interior Design Tool Using Generative AI

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Abstract: In the recent years AI is becoming powerful and we are using AI in every part of our life. There is a sophisticated approach for designing the rooms using AI. AI helps in designing with new thoughts and ideas. This paper presents a web application based interface which helps in designing the empty rooms with new ideas and designs with Generative AI algorithms. In Generative AI the algorithms like stable diffusion and control net diffusion are used and it shows the high performance also. The AI tools help in visualizing the interior design concepts. It helps in reducing the manual work and AI helps in presentation of rooms and selecting the style and rooms in different ways. Finally it presents the rooms in a customized way.

Index Terms - Generative AI, stable diffusion, Control Net

I Introduction :

Interior design using AI has become most prominent nowadays. Traditional methods require manual sketching and complex 3D modelling designs. These are very time-consuming processes and very costly also. Now using deep learning techniques i.e. using generative AI it offers an efficient alternative method for the customized interior design solutions with less effort and less cost.

This paper introduces a custom-built AI-based interior design tool that uses generative models and spatial understanding to turn ordinary room images into professionally styled interiors.

The tool accepts an image of any room along with a chosen room type, like Bathroom, Bedroom, Hall, or Kitchen. It finally converts into a fully furnished, visually enhanced version of the original space. It has an easy-to-use interface, which allows users—including interior designers, homeowners, architects, and real estate professionals—to see the potential of a space in just seconds. The system outputs designs that are not only attractive but also consistent with the original image, thanks to its depth-aware guidance.

Interior designing is majorly built on three major factors. Stable Diffusion is a latent diffusion model which helps in generating high quality images from text and hence it is very efficient. Control Net is another diffusion model which helps in providing the structural information of the rooms, edges maps, depth maps and segmentation maps or even sketches. It is a depth estimation model in capturing the spatial layout from the original image.

These components work together within a Flask-powered backend to ensure quick and reliable performance without depending on external APIs or cloud services. The tool carefully takes the textual prompts to interpret each room type and then provides conceptual interior designs. This innovative design provides a cost-effective and flexible solution for rapid interior design visualization.

II Literature Survey:

Abd-Elnabi et al[1] is transforming interior design by automating few daily tasks. It offers highly customized solutions to the users. In this paper AI tools enhance efficiency and creativity to reduce the manual process. still few challenges are there to main data privacy concerns and human designers Ideas and artistic vision. Future trends indicate collaborative approach where AI complements human creativity for the designing process.

Wu 2024 et.al[2] investigated the combination of traditional Chinese aesthetics with moden Interior design using intelligent design tools and computational techniques.

Chen et.al 2024 [3] proposed an innovative framework to merge aesthetic evaluation and computational efficiency using generative AI diffusion models. The author focused on how the image can be converted if we provided a textual content.

Yang et al. (2025)[4] proposed the use of stable diffusion models to advance AI Interior design models. This study extends the traditional diffusion framework along with controllable conditional mechanisms which allows the designers to generate layout sketches, segmentation maps etc.

Patel and Mandekar (2024)[5] proposed the framework which integrated 3D Modelling Object tracking and marker based augmented reality visualization visualization using the platforms like unity 3D and AR core kit. Th study simulates us to know how aesthetic decision making can be done by virtual design elements into real environments.

AlShkipi and Zahran (2024)[6] proposed the literature review examining how artificial Intelligence has been implemented on various Interior design include space planning, material selection, visualization and automation.

It helps us on how machine learning, computer vision and generative models are transforming traditional design workflows into data driven process.

III Methodology: The proposed system automates the interior design of rooms using generative Artificial Intelligence techniques. It helps in designing the partially furnished room into an fully Interior designer room which is very impressive and very user friendly. The proposed system can be implemented using the below step by step process.

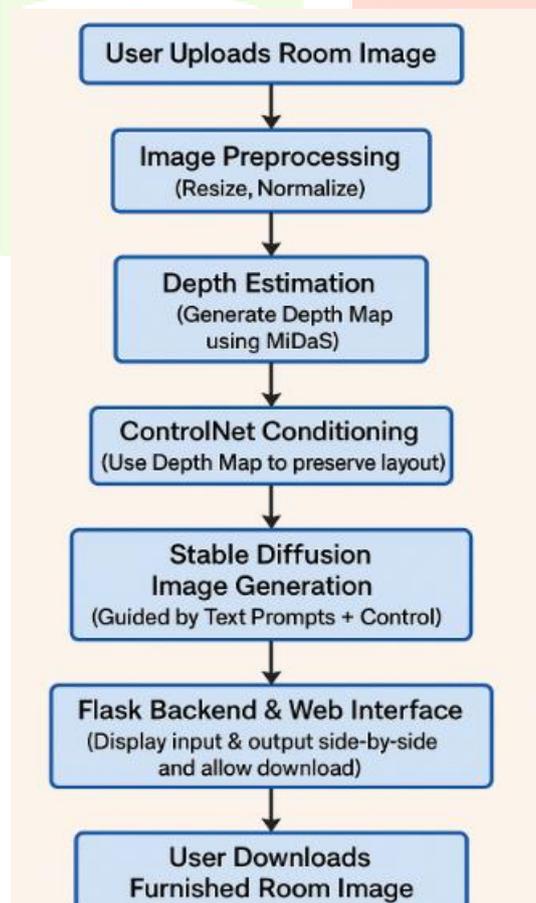


Figure 1: System Architecture

3.1 System Overview:

The entire architecture helps in automating the rooms by using the locally hosted backend powered by AI. The users will upload the empty rooms and the step by step approach will be done as follows.

3.2 Image preprocessing:

The system always accepts the 2D image of an interior space. Before generating the image it undergoes the normalization and resizing for the required generative models.

3.3 Depth Estimation:

Using the pretrained depth estimation model a depth map is generated using MiDas model. This technique helps in finding the object distances and depth cues which are useful for furniture placement and spatial coherence.

The classic approach that how to calculate the depth is using the below equation

$$\text{Depth}(Z) = f \cdot B / d \tag{1}$$

Where depth = depth of the point

F = focal length of the camera in pixels.

B = Base distance between two cameras.

D = disparity

Monocular depth Estimation: To find the depth directly from an RGB image we can use modern depth estimation (Midas) which uses a Convolution neural networks or a vision transformer model.

The estimated formulations are as follows

$I(x,y)$ is an input image

$D(x,y)$ is an predicted depth map.

Θ is an learnable model parameters

The model is trained using the function

$$D(x,y) = f_{\Theta}(I(x,y)) \tag{2}$$

Where f_{Θ} is an trained deep network

3.4 Control Net Conditioning:

It helps in preserving the rooms spatial layout during the interior design generation. By considering the depth maps as control inputs it helps in aligning with original image producing high consistent outputs.

In the stable diffusion process the image generation is done using the text prompt.

Output image = $f_{\Theta}(\text{noise}, \text{text prompt})$

With control net we have additionally added the depth map D.

Output Image = $f_{\Theta}(\text{Noise}, \text{text prompt}, \text{Control Image})$

3.5 Stable Diffusion Image Generation

Stable diffusion model is another deep learning model framework which helps in generating the images from the text. It works with the diffusion process. In the forward process it gradually adds noise to the input image.

The diffusion process works like

$$x_t = \sqrt{\alpha_{tx_0}} + \sqrt{1 - \alpha_{t\epsilon}} \tag{3}$$

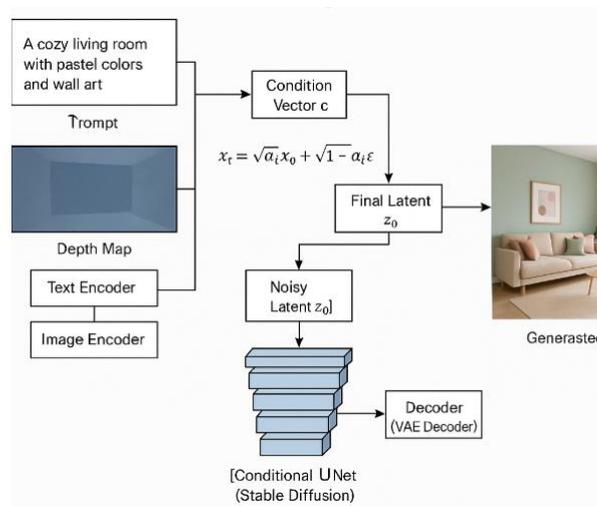


Figure 3.5 Stable Diffusion Process

3.6. Display Output:

The newly created interior image is finally passed back to the frontend and shown to the user. It's a web Interface which shows the Normal Empty rooms on one side and it will create the AI generated Interior design room.

IV .Implementation and Results

The simple web application interface helps the users to generate the Interior well designed rooms by giving some inputs to the application by the users.

The step by step that is followed like

- 1.selecting the input empty rooms
- 2.Selecting the design for the room
- 3.Selecting the particular room ex:living room
- 4.Output showing the AI generated room

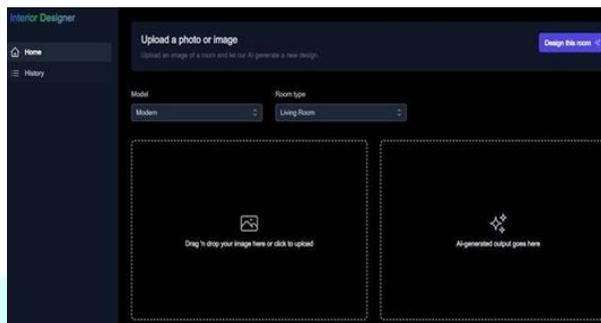


Figure 4.1:Uploading the image

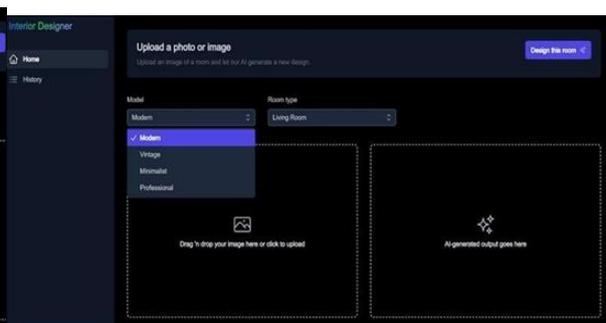


Figure 4.2:Selecting the room

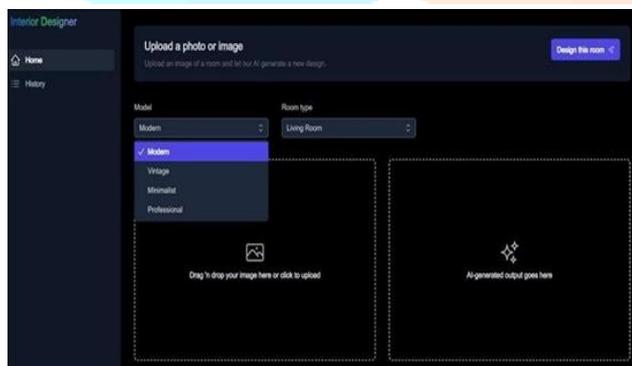


Figure 4.3:Selecting the style

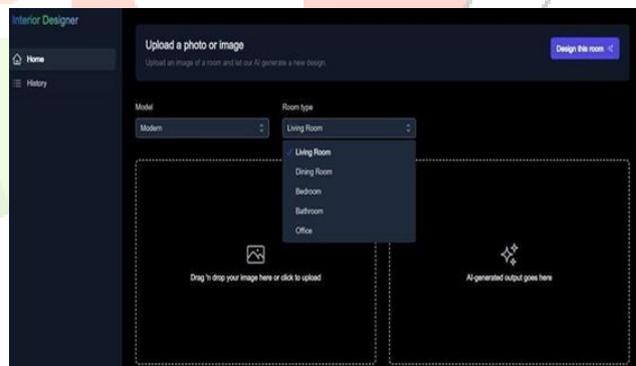


Figure 4.4:Selecting the particular room

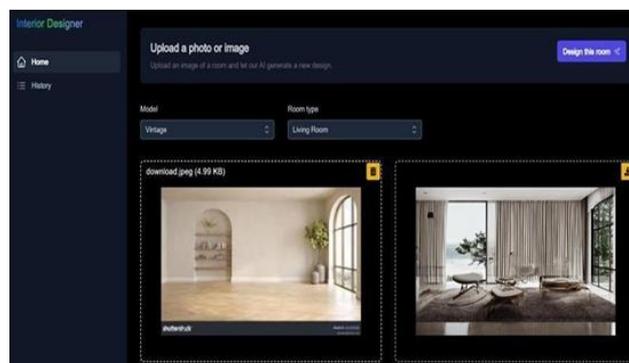


Figure 4.5:Automated design using AI

V Conclusion:

The AI-Based Interior Designing Tool project is a major achievement in harnessing deep learning and generative AI towards real-world, user-focused applications within the context of architecture and home design. The project successfully integrates cutting-edge machine learning models such as Stable Diffusion for photorealistic rendering, ControlNet for structural alignment, and depth estimation for spatial perception to convert plain room photographs to professionally furnished interiors according to the kind of room automatically.

By leveraging a tailor-made, fully functional web interface powered by a Flask server, the tool provides a simple and effective user experience. One can upload the photo of an actual room, select a preferred room type (e.g., Bedroom, Bathroom, Hall, or Kitchen), and get an instant visually enriched, beautiful design output. Local AI models are used to generate the output, so the tool is not reliant on the cloud—resulting in faster processing, cost-effectiveness, and usability.

This tool eliminates the necessity of cumbersome manual rendering or sophisticated 3D modeling software, and as such, is particularly beneficial to designers, architects, real estate agents, and even end-users looking for interior inspiration. It eliminates the gap between conceptual design and visual representation, providing an excellent preview mechanism for suggested adjustments in room design and décor. Its side-by-side input-output design visualization, download feature, and user-friendly

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