WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

What Words Design Interiors

Ansh Vaish[1], Ar. Juwairia[2]

[1]MID 2nd year, Faculty of Architecture and Planning, [2]Professor, Faculty of Architecture and Planning,
Dr. A.P.J. Abdul Kalam University, Lucknow, Uttar Pradesh, India
Qamruddin[2] vaishansh@gmail.com[1], qamruddin.juwairia@foaaktu.ac.in[2]
Doi https://doi.org/10.55248/gengpi.5.0524.1110

ABSTRACT:

This research paper investigates the role of natural language processing and prompt engineering in generating interior design renders using artificial intelligence (AI) platforms. The study analyses how the strategic use of keywords and descriptive prompts can influence the precision and accuracy of AI-generated interior design images. Various design styles, including Scandinavian, Art Deco, Hollywood Regency, and Rajasthani, are explored through a set of 22 defined parameters that encompass elements such as context, volume, color scheme, materials, ambiance, and ornamentation. The research evaluates the performance of different AI platforms, including Prome AI, Fotor AI, Gencraft AI, and Freepik AI, in interpreting prompts and generating corresponding interior design renders. The findings highlight the potential of AI in accelerating the design ideation process while underscoring the importance of effective prompt writing for achieving desired outcomes. The study also discusses the limitations of current AI algorithms and future research directions for enhancing the capabilities of these platforms in the domain of interior design.

Keywords: Interiors, Precision, Accuracy, renders, AI Platforms, Parameters, TTI generation

1.0 Introduction:

The integration of artificial intelligence (AI) and interior design has opened up new avenues for creative exploration and design ideation. In recent years, AI-based platforms that leverage natural language processing (NLP) and text-to-image (TTI) models have emerged as powerful tools for generating interior design renders based on textual prompts. These platforms have the potential to revolutionize the way designers approach the ideation and visualization stages of the design process, offering a more efficient and intuitive means of generating conceptual representations.

However, the effectiveness of these AI-based platforms heavily relies on the ability to communicate design intent through precise and well-structured prompts. The strategic use of keywords, descriptive language, and design terminology plays a crucial role in shaping the accuracy and precision of the AI-generated interior design renders.

This study investigates the role of prompt engineering in shaping the outcomes of AI-generated interior design images. By exploring various design styles and evaluating the performance of different AI platforms, the research aims to provide insights into the power of words in the context of AI-assisted interior design ideation.

1.1 Aim

To explore how a comprehended and well-thought of keywords entered in syntax of AI produces most precise output, analyze its aptness through careful selection of words.

1.2 Objectives

1. Defining a proper set of parameters which are used to define interiors, in TTI implementation and their chronology in producing images from different AI platforms.
2. Study the behaviour and changes in AI generated images, throughout the cycle of prompt inputs and their precision and aptness.
3. Analyse how different AI platforms handle Prompts, their aptness and scope of improvements, in various design styles and analysis of design related keywords.
4. Conclude with a set of instructions on how to and how not to use the prompts to create AI generated precise & accurate images.

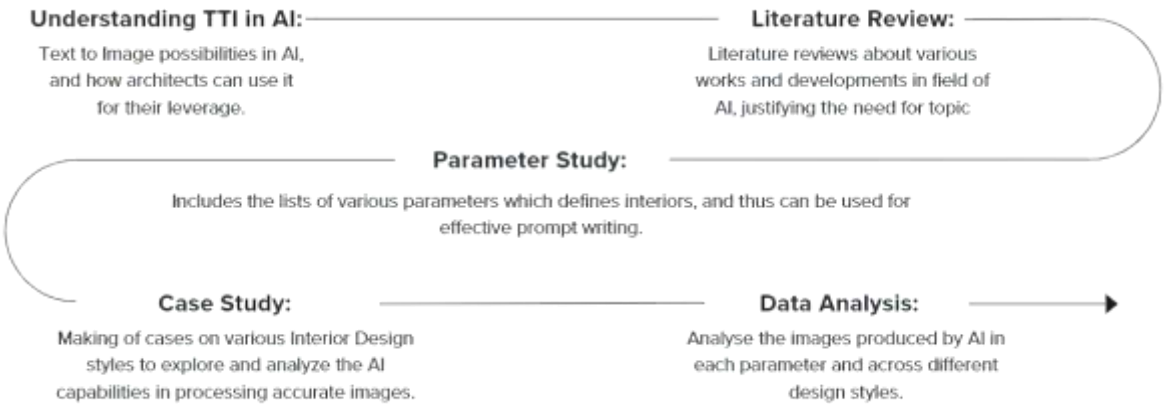
1.3 Scope:

1. This dissertation aims to explore how artificial intelligence, namely natural language processing, can be used to interior design. It will look into how AI may improve the design process by analysing input from the designer's narrative language.
2. The research will examine the usability and usefulness of AI-driven design tools from the perspective of users, including clients and interior designers. It will look at how AI may respond to various requests and its effectiveness.
3. Analyse AI's effectiveness in various design styles and get understanding about it.

1.4 Limitation:

1. Technical concerns, such as inadequate datasets, computer capacity, and AI technologies, may lead to inaccurate interior design outputs.
2. The research's conclusions and recommendations may not be generally applicable due to factors such as the AI model used and the dataset's calibration.
3. This research may limit the amount of interior design entries due to the vast number of possible keywords.
4. Detailed study on multiple AI systems is not feasible due to time constraints of 3 months.
5. The study's findings may become outdated as technology advances.

1.5 Methodology:



The research methodology involved defining a set of 22 parameters that encapsulate various elements of interior design, such as context, volume, design style, colour scheme, materials, ambiance, and ornamentation. These parameters were carefully selected based on their significance in shaping the overall visual and atmospheric qualities of interior spaces.

2.0 Background Study & Literature Review:

The advent of AI-based platforms for interior design ideation is rooted in the advancements in natural language processing (NLP) and text-to-image (TTI) models. NLP techniques enable machines to understand and interpret human language, while TTI models leverage this understanding to generate corresponding visual representations.

Several research studies have explored the potential of AI in the realm of interior design. Chen and Wang (2020) discussed the application of AI technology in interior design, highlighting its ability to bring a "first-class experience" to users. Magdy (2023) introduced the concept of AI art generators, such as Midjourney, which can create entire paintings based on textual inputs. Rodgers and Huxor (2018) explored the role of AI as a medium for communicating design knowledge and information among designers.

Prompt engineering has emerged as a critical aspect of effective AI-assisted design ideation. Oppenlander (2023) emphasized the crucial role of prompt modifiers in shaping the outcomes of text-to-image generation, while Liu and Chilton (2023) proposed design guidelines for crafting effective prompts in TTI generative models.

Despite these advancements, the literature also highlights the limitations and challenges associated with AI-based interior design ideation. McCormack et al. (2023) raised questions about the true nature of creativity in text-to-image generation, while Hong et al. (2023) discussed the importance of curating image sequences for coherent visual storytelling.

3.0 Case Studies:

This comprises of four case studies, each of which represents a different genre of interior design style from a different geographic place, such as Scandinavian Style, Neo-classical Style, Art-Deco, and Rajasthani Style. They have been set in various frames, and images are generated using a total of 22 parameters, during which AI's algorithm capability is evaluated and validated, and keywords and prompts are utilized in accordance with the design style.

These styles were selected for their contrasting aesthetics, historical significance, and global recognition, providing a diverse range of design elements to evaluate the AI platforms' capabilities.

Prompts were crafted incorporating the defined parameters in a structured manner, ensuring a progressive build-up of design details. These prompts were then input into four AI platforms: Prome AI, Fotor AI, Gencraft AI, and Freepik AI. These platforms were chosen based on their popularity, accessibility, and diverse approaches to AI-based image generation.

The generated interior design renders were then analysed for their precision and accuracy in reflecting the specified prompts. A quantitative scoring system was developed, assigning a percentage value to each prompt based on its accurate representation in the generated image. This allowed for a comprehensive evaluation of the AI platforms' performance across different design styles and parameters.

3.1 Scandinavian Living Room:

The case study focuses on the creation of a Scandinavian design-style living room through a series of gradual enhancements in a text-to-image generation context, using AI. Each step introduces additional details that refine the visualization, starting from the basic dimensions of the room and progressing to intricate elements like materials, fabrics, and motifs.

Basic Parameters: The living room measures 4 by 6 meters with a height of 5 meters.

Fenestration: Includes a large glass window with a wooden frame, enhancing natural light and open visuals.

View: The window offers a scenic river view, integrating nature with the interior.

Spatial Composition: The space is designed to comfortably seat seven people, indicating its functionality and social intent.

Interior Design Style: Adopts Scandinavian style, known for its simplicity, minimalism, and functionality, employing light wood and natural materials.

Color and Texture: Utilizes a burnt orange color palette and natural brick texture, adding warmth and depth.

Materials: Features natural wooden vinyl flooring, aligning with Scandinavian emphasis on natural materials.

Ambience: Aimed to be natural and cozy, reflecting the Scandinavian value of comfort.

Lighting and Decor: Includes accent pendant lighting and minimal ornamentation, with a statement picture frame, focusing on simplicity and subtle aesthetic enhancements.

Furniture: Incorporates vintage and minimal wooden furniture, supporting the theme of functionality and understated elegance.

Additional Details: The camera angle from above, inclusion of biophilic elements like a rubber fig plant, and fabrics such as wool and linen enrich the visualization and textural feel.

Motif and Style: Introduces a cross motif texture, adding a subtle cultural or traditional touch, rendered in an artistic sci-fi style, which may suggest a unique, modern twist on the classic Scandinavian design.

The progression shows how each parameter contributes to a holistic design that embodies the principles of Scandinavian interior design while tailored to a specific aesthetic vision. This methodology demonstrates how detailed and layered inputs in AI-driven text-to-image generation can effectively translate nuanced design concepts into visual outputs.

3.2 Art- Deco Entrance Lobby

This case study outlines the creation of an Art Deco entrance lobby through a series of specified parameters in a text-to-image generation context using AI. Each parameter adds depth and detail to the envisioned space, capturing the essence of the glamorous and elegant Art Deco style from the 1920s-1940s.

Context: An entrance lobby.

Volume: The lobby measures 3 by 6 meters with a height of 4 meters.

Fenestration: Features a Crittall window with geometric stained glass, adding a touch of sophistication.

Background View: Offers a picturesque mountain view, enhancing the grandeur of the space.

Spatial Composition: Includes a luggage rack and a stool, ensuring functionality while maintaining elegance.

Interior Design Style: Adopts the Art Deco style, known for its sleek lines and luxurious details.

Color Scheme: Utilizes a bold color palette with cherry yellow contrast, adding vibrancy and richness.

Texture: Incorporates glossy and rich textures, enhancing the opulence of the space.

Materials: Features ebony, zebrawood, and marble, reflecting the luxurious materials often associated with Art Deco.

Ambience: Creates a glamorous ambiance, evoking the elegance and sophistication of the era.

Lighting: Includes glass Lalique lamps, adding a touch of artistry and refinement to the lighting scheme.

Ornamentation: Incorporates chequered black ceramic tile and low relief geometric decoration wall panels, adding visual interest and depth.

Decor: Includes peculiar wooden furniture with a Japanese lacquer finish, adding uniqueness and style to the space.

Camera Angle: Utilizes a low camera angle view, enhancing the sense of grandeur and scale.

Plants/Biophilia: Features ZZ plants, adding a touch of nature to the interior.

Fabrics: Incorporates silk and faux silk fabrics, adding luxury and texture to the space.

Motif: Includes triangular and zigzag pattern motifs, characteristic of the Art Deco style.

Image Proportion: Maintains a 2:3 proportion to ensure visual balance.

Rendering Style: Adopts an Artistic Fantasy 23 rendering style, adding a whimsical and fantastical element to the visualization.

Each parameter contributes to the creation of a visually stunning and luxurious Art Deco entrance lobby, capturing the essence of this iconic design style while incorporating modern elements and artistic flair.

3.3 Hollywood Regency Style Salon

This case study details the process of generating an image of a salon in the Hollywood Regency style using text-to-image generation with AI. Each parameter contributes to capturing the opulent and glamorous essence of the Hollywood Regency aesthetic popularized in the 1930s-1950s.

Context: The salon setting.

Volume: Dimensions of the salon - 4 by 6 meters with a height of 4 meters.

Fenestration: Two arched windows, adding architectural elegance.

Background View: Urban street view visible through the windows.

Spatial Composition: Includes four styling chairs for the salon.

Interior Design Style: Adopts the Hollywood Regency design style, known for its lavish and expressive characteristics.

Colour Scheme: Features a turquoise color palette, adding vibrancy and luxury.

Texture: High gloss texture enhances the richness of the space.

Materials: Incorporates chequerboard flooring for a classic touch.

Ambience: Creates an opulent ambiance, aligning with the Hollywood Regency style.

Lighting: Decorative wall lamps enhance the glamorous lighting scheme.

Ornamentation: Includes a tropical motif wall panel for added visual interest.

Decor: Modern rugs with animal prints contribute to the lavish decor.

Furniture: Mirrored furniture and cabinetry reflect the Hollywood Regency style's penchant for luxury and glamour.

Camera Angle: Utilizes an ultra-wide camera angle to capture the grandeur of the space.

Plants/Biophilia: Tropical potted plants introduce a touch of nature to the interior.

Fabrics: Fur upholstered stools add texture and luxury to the seating.

Motif: Incorporates a bamboo motif chinoiserie partition, adding an exotic flair to the space.

Each parameter works together to create a visually striking salon that embodies the essence of Hollywood Regency style, characterized by its opulence, glamour, and theatricality.

3.4 Rajasthani Style Banquet Hall

This case study outlines the process of generating an image of a banquet hall in the Rajasthani interior design style using text-to-image generation with AI. Each parameter contributes to capturing the bold, vibrant, and ornate essence of Rajasthani aesthetics.

Context: A banquet hall setting.

Volume: Specifies the grand scale of the banquet hall with an 8-meter high ceiling.

Fenestration: Features pointed arched windows, adding architectural elegance.

Background View: Offers a beach view, enhancing the ambiance of the space.

Spatial Composition: Specifies the capacity of the banquet hall for 50 people.

Interior Design Style: Adopts the Rajasthani design style, known for its bold and vibrant characteristics.

Colour Scheme: Utilizes a contrasting red and white color palette, adding vibrancy and richness.

Texture: Specifies a matt rough texture, adding depth and dimension to the interior.

Materials: Includes makrana marble flooring with mandala stone inlay, reflecting traditional Rajasthani materials.

Ambience: Creates a royal and warm ambiance, evoking the regal atmosphere of Rajasthan.

Lighting: Features vintage chandeliers, adding elegance and illumination to the space.

Ornamentation: Specifies intricate ornamentation, adding decorative detail to the interior.

Decor: Includes stone screen partitions, enhancing the visual appeal of the space.

Furniture: Specifies wooden furniture with brass hardware, reflecting the traditional craftsmanship of Rajasthan.

Camera Angle: Utilizes a bird's eye view, capturing the grandeur of the banquet hall.

Plants/Biophilia: Includes monstera plants, adding a touch of nature to the interior.

Fabrics: Specifies velvet and silk fabric curtains, adding luxury and texture to the space.

Motif: Incorporates a lotus motif on the ceiling, reflecting traditional Rajasthani symbolism and aesthetics.

Each parameter contributes to the creation of a visually stunning banquet hall that embodies the bold, vibrant, and ornate characteristics of Rajasthani interior design style, transporting inhabitants and visitors to an environment that evokes exotic luxury and cultural richness.

4.0 Results & Discussion

4.1 Precision Analysis of Case Studies:

The study revealed that the AI platforms demonstrated varying levels of precision in interpreting prompts and generating corresponding interior design renders. The analysis showed that the accuracy of the generated images was generally above 80% across the different design styles.

In the Scandinavian living room case study, the AI platforms performed well in capturing the overall design style, color scheme, and ambiance. However, certain prompts, such as camera angle and motif design, posed challenges for the AI algorithms, resulting in slightly lower accuracy scores.

The Art Deco entrance lobby case study yielded the highest precision rates, with AI platforms successfully interpreting prompts related to materials, ornamentation, and decor elements. The distinctive geometric patterns and motifs characteristic of the Art Deco style were accurately represented in the generated renders.

The Hollywood Regency salon case study presented some challenges for the AI platforms, particularly in interpreting prompts related to specific decor elements, such as tropical motif wall panels and mirrored cabinetry. This highlights the potential limitations of AI algorithms in accurately representing intricate design details.

In the Rajasthani banquet hall case study, the AI platforms struggled with prompts involving intricate patterns and motifs specific to the Rajasthani design style. However, they performed well in capturing the overall ambiance, colour scheme, and materials associated with this design style.

4.2 Comparative Analysis of AI Platforms:

The comparative analysis of the AI platforms revealed that no single platform consistently outperformed the others across all design styles. Instead, the precision of the generated renders depended on the specific prompts and the AI platform's ability to interpret and process the provided information.

Prome AI demonstrated a strong overall performance, with precision rates ranging from 85% to 95% across the different design styles. It excelled in the Hollywood Regency salon case study, achieving a 95% accuracy rate.

Fotor AI exhibited varying degrees of precision, ranging from 75% in the Hollywood Regency salon case study to 100% in the Art Deco entrance lobby case study. This platform's performance appeared to be highly dependent on the complexity and specificity of the prompts.

Gencraft AI maintained a consistent precision rate of 85% across most design styles, showcasing a balanced performance in interpreting and generating interior design renders.

Freepik AI stood out in the Scandinavian living room case study, achieving a 95% accuracy rate. However, its performance varied across the other design styles, ranging from 85% to 90% precision.

4.3 The Role of Effective Prompt Writing:

The research findings highlighted the importance of effective prompt writing in achieving desired outcomes from AI-based interior design ideation platforms. Prompts that were concise, descriptive, and incorporated relevant design terminology yielded more accurate and precise interior design renders.

Effective prompts followed a structured approach, progressively building upon design elements such as context, volume, color scheme, materials, and ornamentation. The use of specific design-related keywords and descriptors played a crucial role in guiding the AI algorithms towards generating visually accurate representations.

However, the study also revealed that overly complex or highly specific prompts could sometimes overwhelm the AI algorithms, leading to inconsistencies or omissions in the generated renders. Finding the right balance between level of detail and conciseness emerged as a key challenge in prompt engineering for interior design ideation.

4.4 Limitations and Future Research Directions:

While the study demonstrated the potential of AI-based platforms for interior design ideation, it also highlighted several limitations and areas for future research and development.

One of the notable limitations is the difficulty in accurately representing intricate design elements, such as intricate patterns, motifs, and ornamentations specific to certain cultural or historical design styles. The AI algorithms struggled to interpret and visually represent these nuanced details, indicating a need for further refinement and expansion of the underlying datasets and models.

5.0 Conclusion

The research findings highlighted the importance of effective prompt writing in achieving desired outcomes from AI-based interior design ideation platforms. Prompts that were concise, descriptive, and incorporated relevant design terminology yielded more accurate and precise interior design renders.

Effective prompts followed a structured approach, progressively building upon design elements such as context, volume, color scheme, materials, and ornamentation. The use of specific design-related keywords and descriptors played a crucial role in guiding the AI algorithms towards generating visually accurate representations.

However, the study also revealed that overly complex or highly specific prompts could sometimes overwhelm the AI algorithms, leading to inconsistencies or omissions in the generated renders. Finding the right balance between level of detail and conciseness emerged as a key challenge in prompt engineering for interior design ideation.

References:

List all the material used from various sources for making this project proposal

Research Papers:

1. Samuel, N. R. (2022). Computational Technology and Artificial Intelligence (AI) Revolutionizing Interior Design Graphics and Modelling,.
2. Chinmay Kulkarni, S. D. (2023). A Word is Worth a Thousand Pictures: Prompts as AI Design Material .
3. Farrland, A. (2024, January 1). *Unite*. Retrieved from 5 Best AI for Interior Design: https://www.unite.ai/best-ai-interior-design-tools/
4. Jonas Oppenlaender, F. (2023). A Taxonomy of Prompt Modifiers for Text-To-Image Generation.
5. Lee, J. K.-K. (2020). Stochastic Detection of Interior Design Styles Using a Deep-Learning Model for Reference Images.
6. Magdy, D. (2023). The Use of Artificial Art Generator "Midjourney" in Artistic & Advertising Creativity.
7. McCormack, J. C. (2023). Is Writing Prompts Really Making Art?
8. Oppenlaender J, S. J. (2022). Perceptions and Realities of Text-to-Image Generation. *Proceedings of the 26th International Academic Mindtrek Conference.* , 279-288.
9. Oppenlander, J. (2023). The Creativity of Text-to-Image Generation.
10. Paul Rogers, A. H. (2018). The role of artificial intelligence as `text' within design.
11. REEDY, C. (2023). *Futurism*. Retrieved from https://futurism.com/kurzweil-claims-that-the-singularity-will-happen-by-2045
12. Vaish, A. (2023, December 12). *Fotor AI*. Retrieved from https://www.fotor.com/ai-art-generator/

13. Vaish, A. (2023, December 12). *Freepik AI*. Retrieved from https://www.freepik.com/ai/image-generator
14. Vaish, A. (2023, December 12). *gencraft*. Retrieved from https://gencraft.com/generate
15. Vaish, A. (2023, November 24). *Prome AI*. Retrieved from https://www.promeai.com/ai-image-generation
16. Vivian Liu, L. B. (2023). *Design Guidelines for Prompt Engineering Text-To-Image Generative Models*.
17. Vivian Liu, L. B. (2023). Beyond Text-to-Image: Multimodal Prompts to Explore Generative AI .
18. Xudong Hong. (2022). *Proceedings of the 2022*.
19. Xudong Hong, A. S. (2023). Visual Writing Prompts: Character-Grounded Story Generation with Curated Image Sequences.
20. Zixuan Chen, X. W. (2020). Application of AI technology in Interior Design.