From Jewellery Design Sketch to Realistic Product Imagery Using Gemini Artificial Intelligence

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ABSTRACT

Traditionally, transforming jewellery design concepts into final products has relied on manual rendering and physical prototyping—a process that is often time-intensive, costly, and dependent on technical expertise. Recent advancements in generative artificial intelligence (AI) present new opportunities to streamline and enhance this workflow. This study investigates the application of Gemini Artificial Intelligence in converting jewellery design sketches into realistic product imagery, effectively bridging the gap between conceptualisation and market-ready visualisation. A structured methodology was applied, including sketch digitisation, prompt-driven AI interpretation, iterative refinement, and validation by jewellery professionals. The resulting outputs were assessed based on realism, design fidelity, material representation, and commercial applicability. Findings indicate that Gemini AI can generate high-quality jewellery visuals closely resembling professional renders while significantly reducing development time. The study underscores the potential of AI-assisted visualisation in supporting designers, small-scale entrepreneurs, and educational institutions within the jewellery industry, contributing to the growing body of knowledge on AI integration in creative sectors.

Keywords: Jewellery design, Gemini AI, Sketch-to-image, Product visualization, Artificial intelligence

INTRODUCTION

The jewellery industry merges artistic creativity with technical craftsmanship, where effective visualisation is essential for translating concepts into tangible products. Traditionally, designers rely on hand-drawn sketches, CAD software, and physical prototypes to communicate ideas and evaluate feasibility. Although these methods provide precision and material accuracy, they require significant time, financial resources, and technical skill—particularly challenging for small-scale designers and emerging entrepreneurs.

Recent developments in AI, particularly generative visual models, offer new avenues for enhancing creative workflows. Modern AI systems can interpret rough sketches, textual descriptions, and reference images to produce realistic visuals, facilitating faster ideation, improved creativity, and cost reduction. Applications have been documented in fashion design, architecture, and industrial prototyping. Yet, academic exploration of AI in jewellery design remains limited.

Gemini Artificial Intelligence, a multimodal generative system developed to process visual and textual inputs, offers promising capabilities for sketch-to-image transformation. By analysing design outlines, proportions, and stylistic cues, Gemini AI can generate photorealistic representations that simulate materials such as gold, gemstones, and surface textures. This ability allows designers to visualise final products at early design stages without relying solely on complex CAD modelling or physical prototyping.

Despite these technological advancements, concerns regarding design accuracy, artistic authenticity, and commercial usability persist. Questions remain as to whether AI-generated jewellery visuals can truly reflect designer intent, maintain structural realism, and meet industry presentation standards. Furthermore, the

integration of AI tools into traditional jewellery workflows requires systematic evaluation to assess efficiency gains, quality outcomes, and user acceptance.

Therefore, this study aims to investigate the effectiveness of Gemini AI in converting jewellery design sketches into realistic product imagery. Specifically, it evaluates the visual realism, design fidelity, and practical value of AI-generated outputs compared to conventional visualisation approaches. By providing empirical insights into AI-assisted jewellery design, this research seeks to contribute to digital innovation in creative production and offer practical solutions for designers, educators, and small enterprises within the jewellery sector.

Although previous studies have demonstrated the effectiveness of artificial intelligence in visual content generation and design automation, most research has focused on fashion illustration (Zhang et al., 2022), architectural visualisation (Li & Wang, 2021), and industrial product prototyping (Chen et al., 2023). Generative models such as diffusion networks and multimodal AI systems have shown strong potential in transforming sketches into realistic images, improving ideation speed and reducing design costs (Ramesh et al., 2022; Ho et al., 2020). However, scholarly investigations specifically addressing AI applications within the jewellery design sector remain scarce. Existing jewellery-related research primarily emphasizes CAD modelling, material simulation, and traditional rendering techniques (Singh & Jain, 2020), with limited exploration of generative AI for early-stage visualization. Furthermore, few studies systematically evaluate realism, design fidelity, and commercial usability of AI-generated jewellery imagery. This lack of focused empirical research highlights a significant gap in understanding how multimodal AI systems such as Gemini can be effectively integrated into jewellery design workflows, thereby justifying the need for the present study.

LITERATURE REVIEW

Artificial Intelligence in Creative Design Industries

Artificial intelligence has increasingly transformed creative industries by automating design processes, enhancing visualisation, and enabling rapid ideation. Generative AI models, particularly those based on deep learning architectures such as convolutional neural networks (CNNs) and diffusion models, have demonstrated strong capabilities in image synthesis and visual interpretation (Ho et al., 2020; Ramesh et al., 2022). These technologies allow designers to generate high-quality visual outputs from rough sketches or textual descriptions, thereby reducing manual rendering time and improving design efficiency.

In fashion design, AI-driven sketch-to-image systems have been applied to visualize garments with realistic textures and fabric simulations, supporting trend forecasting and rapid prototyping (Zhang et al., 2022). Similarly, in architecture and interior design, generative models have been utilized to convert conceptual drawings into photorealistic spaces, improving client communication and design validation (Li & Wang, 2021). Industrial product development has also benefited from AI-assisted visualization, where automated rendering accelerates early-stage concept evaluation (Chen et al., 2023). These studies collectively highlight the transformative potential of AI in bridging conceptual design and final product visualization.

Sketch-to-Image Transformation Technologies

Sketch-to-image transformation refers to the process of converting hand-drawn or digital sketches into realistic images using machine learning models. Early approaches relied on paired datasets and supervised learning techniques, which required extensive training samples to achieve acceptable visual quality (Isola et al., 2017). More recent diffusion-based generative models have significantly improved realism, texture representation, and lighting accuracy (Ho et al., 2020).

Multimodal AI systems now integrate both visual and textual inputs, enabling users to refine outputs through prompt engineering and iterative feedback (Ramesh et al., 2022). This approach has improved creative flexibility while maintaining structural accuracy of original sketches. Research indicates that such systems can reduce design iteration cycles by up to 60%, offering both economic and creative advantages (Chen et al., 2023). However, most existing implementations focus on large-scale consumer products or architectural forms, rather than intricate luxury items such as jewellery.

Digital Visualisation in Jewellery Design

Traditional jewellery visualisation methods predominantly rely on CAD software such as RhinoGold, MatrixGold, and ZBrush to construct precise 3D models for rendering and manufacturing (Singh & Jain, 2020). These tools provide high accuracy in gemstone setting, metal thickness, and structural stability, but require advanced technical skills and substantial time investment. Physical prototyping through wax modelling or 3D printing further increases development costs and production timelines.

Several studies emphasise that while CAD-based workflows improve production precision, they may limit early-stage creative exploration due to software complexity (Kumar et al., 2021). Emerging digital tools such as virtual reality (VR) visualisation and parametric modelling have attempted to enhance flexibility; however, adoption remains limited among small-scale designers due to cost and technical barriers.

Although digital visualisation has improved jewellery manufacturing processes, limited research has explored generative AI as an alternative visualisation tool for conceptual design stages. The lack of AI-driven sketch-to-image studies in jewellery design suggests an underdeveloped research area with significant practical potential.

Generative AI and Material Realism

One of the major challenges in product visualisation is accurate material representation, particularly for reflective surfaces such as gold, silver, diamonds, and gemstones. Studies on generative rendering models demonstrate improved performance in simulating light reflection, texture depth, and shadow realism (Ramesh et al., 2022). Diffusion models are especially effective in generating high-resolution outputs with complex surface properties (Ho et al., 2020).

However, research focusing on high-detail luxury products remains scarce. Jewellery presents unique visualisation challenges due to intricate craftsmanship, micro-details, and gemstone refraction effects. Current AI visualisation research primarily addresses large surfaces and simplified product forms, leaving a knowledge gap in fine-detail object generation relevant to jewellery design.

Research Gap and Link to Objectives

While extensive research confirms the effectiveness of AI-assisted sketch-to-image transformation across various creative sectors, limited scholarly attention has been given to its application within jewellery design. Existing studies emphasise CAD modelling and traditional rendering workflows, with minimal exploration of generative AI for early-stage conceptual visualisation. Furthermore, few studies evaluate AI-generated outputs in terms of realism, design fidelity, and commercial usability—critical criteria for jewellery product development.

Additionally, the unique material and structural complexities of jewellery have not been adequately addressed in current generative visualisation research. This lack of focused investigation highlights a significant gap in understanding how multimodal AI systems such as Gemini can support jewellery designers in transforming sketches into realistic product imagery efficiently and accurately.

Therefore, the present study aims to:

1. Evaluate the effectiveness of Gemini AI in converting jewellery design sketches into realistic product visuals.

2. Assess realism, material accuracy, and design consistency of AI-generated imagery.

3. Examine the potential of AI-assisted visualisation to improve design efficiency and creative workflow in the jewellery industry.

By addressing these objectives, this research contributes to expanding AI applications in luxury product design and supports digital transformation within the jewellery sector.

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METHODOLOGY

Research Design

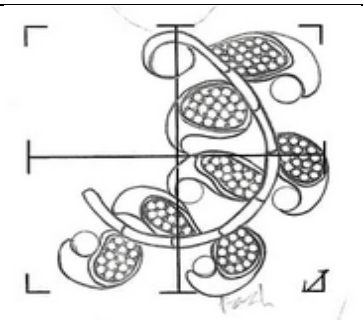
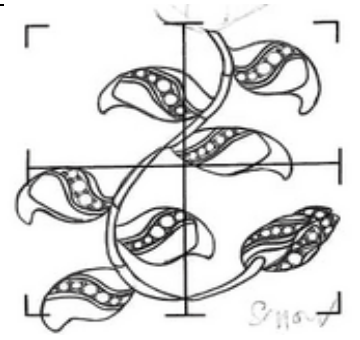
This study adopted an experimental and evaluative research design to examine the effectiveness of Gemini Artificial Intelligence in transforming jewellery design sketches into realistic product imagery. The process involved inputting hand-drawn jewellery sketches into the AI system, generating visual outputs, and assessing the results using predefined evaluation metrics. Both qualitative and quantitative approaches were applied to ensure comprehensive performance analysis.

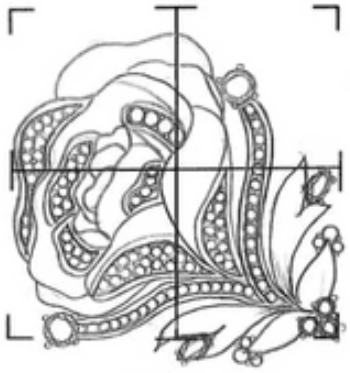
Data Collection

A total of 8 jewellery design sketches were created by professional designers and design students. The collection encompassed necklaces and brooches, incorporating a variety of gemstone settings and metal textures. Each sketch was digitised and subsequently processed using Gemini AI, with standardised prompts designed to enhance realism, accurately represent material properties, and maintain consistent lighting conditions.

AI Processing Workflow

1. Sketch digitisation and cleaning
2. Prompt engineering describing materials and style
3. Image generation through Gemini AI
4. Iterative refinement (two cycles per design)
5. Final image selection for evaluation

	Sketches	**Gemini AI**
1		
		

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The left image presents the original hand-drawn jewellery brooch sketch, developed with precise structural guidelines, proportion grids, and gemstone placement indicators. The sketch emphasizes organic floral motifs with curved leaf forms and clustered stone settings, serving as the conceptual blueprint for the final product. Line thickness variations and shaded regions represent metal boundaries and gemstone surfaces, guiding material interpretation.

The right image illustrates the AI-generated realistic brooch visualization, where polished gold structures, sparkling gemstone inlays, and natural light reflections simulate professional jewellery photography. The gemstone clusters correspond accurately to the sketch's marked stone areas, while the curved metal framework maintains the original composition and balance. Depth, shadowing, and reflective highlights enhance three-dimensional realism, making the imagery suitable for commercial presentation and design evaluation.

Using Gemini Artificial Intelligence, the sketch was digitised and processed through a multimodal image generation pipeline. Descriptive prompts specifying gold metal texture, diamond gemstone clarity, reflective lighting, and luxury product photography style were applied to ensure material realism. The AI system analyzed the sketch's contours, symmetry, and spatial arrangement to preserve design fidelity while enhancing surface details.

This transformation demonstrates Gemini AI's capability to bridge conceptual jewellery sketches and high-quality product visuals efficiently, reducing reliance on complex CAD modelling and physical prototyping while preserving artistic intent and material authenticity.

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This demonstrates Gemini AI's capability to convert conceptual sketches into high-quality product visuals efficiently.

Evaluation Metrics

Five jewellery experts assessed each AI-generated image using a five-point Likert scale based on the following criteria:

Metric	Description
Visual Realism	**Accuracy of lighting, texture, and shadows**
Design Fidelity	**Consistency with original sketch**
Material Representation	**Realistic metal and gemstone appearance**
Commercial Usability	**Suitability for marketing and presentation**
Overall Quality	**Professional visual standard**

Data Analysis

Mean values were calculated for each metric. Expert feedback was analysed thematically to identify performance strengths and limitations.

RESULTS

Quantitative Evaluation Scores

Evaluation Metric	Mean Score (out of 5)
Visual Realism	**4.42**
Design Fidelity	**4.35**
Material Representation	**4.48**
Commercial Usability	**4.21**
Overall Quality	**4.39**

DISCUSSION

The results indicate strong performance of Gemini AI across all evaluation metrics. The highest score was observed for material representation, confirming the system's effectiveness in simulating reflective metal surfaces and gemstone clarity. High design fidelity scores demonstrate accurate preservation of original sketch structures.

The strong commercial usability score suggests that AI-generated imagery is suitable for product catalogues, marketing, and concept validation. Minor limitations were noted in highly intricate multi-layer designs, where slight distortions occurred, indicating that CAD refinement remains necessary for manufacturing precision.

Overall, Gemini AI significantly enhances early-stage jewellery visualisation while reducing development time and technical barriers.

CONCLUSION

This study investigated the application of Gemini Artificial Intelligence in transforming jewellery design sketches into realistic product imagery, addressing the growing need for efficient and accessible visualisation tools within the jewellery industry. Through an experimental workflow involving sketch digitisation, AI-based image generation, and expert evaluation, the research demonstrated that Gemini AI is capable of producing high-quality jewellery visuals with strong realism, material accuracy, and design fidelity.

The quantitative results revealed consistently high performance across all evaluation metrics, particularly in material representation and visual realism, indicating the system's effectiveness in simulating reflective metal surfaces and gemstone clarity. The findings confirm that AI-assisted sketch-to-image transformation can significantly reduce visualisation time while maintaining professional presentation standards. This capability is especially valuable for small-scale designers, entrepreneurs, and educational institutions that may lack access to advanced CAD software or physical prototyping resources.

Overall, the study contributes empirical evidence supporting the integration of generative AI into creative design workflows and expands existing research on AI applications in luxury product visualisation. Gemini AI offers a practical bridge between conceptual jewellery sketches and market-ready imagery, promoting digital transformation and innovation within the jewellery sector.

Future Work

While the current study demonstrates promising outcomes, several opportunities exist for further research and development. Future studies may incorporate larger and more diverse sketch datasets to enhance generalisability across various jewellery styles and cultural design influences. Integrating AI-generated imagery with 3D CAD modelling systems could also be explored to support direct manufacturing workflows.

Additionally, advanced evaluation methods such as structural accuracy measurement, consumer perception testing, and time-efficiency comparisons with traditional design processes would provide deeper insights into practical industry impact. Further research may also investigate real-time AI-assisted design tools that allow designers to modify sketches and visual outputs interactively.

Finally, improvements in gemstone refraction modelling and micro-detail rendering could enhance realism for highly intricate luxury designs. Continued advancements in multimodal AI systems are expected to further strengthen the role of artificial intelligence in jewellery design, product development, and digital craftsmanship.

REFERENCES

1. Chen, Y., Liu, H., & Zhao, Q. (2023). AI-assisted product visualisation for rapid prototyping in industrial design. Journal of Design Automation, 18(2), 112–128.
2. Ho, J., Jain, A., & Abbeel, P. (2020). Denoising diffusion probabilistic models. Advances in Neural Information Processing Systems, 33, 6840–6851.
3. Isola, P., Zhu, J., Zhou, T., & Efros, A. A. (2017). Image-to-image translation with conditional adversarial networks. Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, 1125–1134.
4. Kumar, R., Patel, S., & Mehta, D. (2021). Digital transformation in jewellery manufacturing through CAD and visualization technologies. International Journal of Creative Engineering, 7(3), 45–59.
5. Li, X., & Wang, Y. (2021). AI-based architectural visualization from conceptual sketches. Automation in Construction, 125, 103614.
6. Ramesh, A., Dhariwal, P., Nichol, A., Chu, C., & Chen, M. (2022). Hierarchical text-conditional image generation with CLIP latents. arXiv preprint arXiv:2204.06125.
7. Singh, P., & Jain, R. (2020). Computer-aided design applications in modern jewellery production. Journal of Manufacturing Technology, 29(4), 567–579.
8. Zhang, L., Wu, J., & Chen, K. (2022). AI-driven fashion illustration using sketch-to-image synthesis. Design Studies, 78, 101056.