



Traditional and Modern Architectural Design Generation for Kıyıköy in Türkiye Utilizing the DALL-E Artificial Intelligence Model

Samet Memiş¹ , Hatice Çiğdem Zağra Öz² , Sibel Özden Omuzlu³ 

Article Info

Received: 13 May 2025

Accepted: 27 Jun 2025

Published: 30 Jun 2025

Research Article

Abstract – This study utilizes the DALL-E artificial-intelligence (AI) model to generate both traditional and modern architectural visuals that follow the Kıyıköy Conservation Master Plan for the historic coastal town of Kıyıköy, Türkiye. The process has two stages. First, key features of traditional architecture—such as morphology, materials, and design types—are extracted from the plan and used as text prompts; DALL-E then creates visual representations of heritage structures. Next, the prompts are adjusted to incorporate contemporary design goals while respecting constraints on height, façade materials, setbacks, roof shapes, and window-door ratios. A five-point compliance framework, based directly on the conservation plan, is used to evaluate each output: (1) building height and number of stories, (2) lot width and distance to neighbors, (3) roof type, (4) façade materials, and (5) window-door ratios and openness. Figure 4b meets all standards, while Figures 4a, 4c, and 4d meet four criteria, falling short only in fenestration proportions. The results demonstrate that DALL-E, guided by regulation-aware prompts, can quickly generate concepts that adhere to conservation rules, emphasizing its usefulness for heritage-sensitive, rule-based design projects. Incorporating zoning and morphological constraints directly into prompts provides a new, reproducible approach for integrating generative AI into preservation-focused architectural workflows.

Keywords – Traditional architectural design, modern architectural design, artificial intelligence, DALL-E, Kıyıköy

1. Introduction

Realistic photographs of natural and artificial scenes can now be produced thanks to the recent development of deep learning techniques that utilize enormous text-image datasets, combined with contrastive learning and transformer structures [1]. Numerous visual, architectural, and constructional design disciplines may benefit from or be automated by these techniques. Due to the intrinsic complexity of such created scenes, existing assessments of their usefulness in literature only capture a small portion of the potential for such generative methods to disrupt applied design disciplines-and perhaps even help them.

Artificial intelligence (AI) in traditional architecture has gained significant attention recently. While traditional architecture refers to a range of vernacular buildings and structures that reflect the cultural identity of a particular region, AI offers a way to enhance and optimize traditional architecture to meet contemporary demands. One of the primary benefits of AI in conventional architecture is its impact on the design process. AI algorithms can analyze large amounts of data and generate optimized designs considering factors such as

¹samettmemis@gmail.com (Corresponding Author); ²hcigdem.zagra@rumeli.edu.tr; ³sibelozdenomuzlu@halic.edu.tr

¹Department of Marine Engineering, Faculty of Maritime, Bandırma Onyedi Eylül University, Balıkesir, Türkiye

²Department of Architecture, Faculty of Art Design and Architecture, İstanbul Rumeli University, İstanbul, Türkiye

³Department of Architectural Design Computing, Graduate School, İstanbul Technical University, İstanbul, Türkiye

³Department of Digital Game Design, Faculty of Fine Arts, Halic University, İstanbul, Türkiye

the site, environmental conditions, and cultural context. This technology enables architects to design buildings that are both functional and aesthetically pleasing, as well as culturally relevant. By utilizing AI, architects can leverage a wealth of historical and cultural knowledge to design structures that reflect the unique identity of a particular region while also meeting contemporary needs. Another benefit of AI in traditional architecture is its ability to preserve and restore historic buildings. AI-powered software can analyze data and identify potential areas of deterioration or damage, allowing for timely and precise restoration efforts. This technology can also help maintain historical structures, ensuring they remain safe and structurally sound for future generations. Moreover, AI can also be used in the construction phase of traditional architecture. Technology can optimize construction methods, reduce material waste, and improve efficiency, reducing the overall construction cost. Additionally, AI can assist in implementing sustainable design practices, making traditional buildings more environmentally friendly and energy efficient.

As mentioned above, although AI and architectural design through AI have been a concern for architects over the last three to five years, Makoto Sei Watanabe [2] was one of the first architects to design using an AI interface in the late 1990s. His work involved a variety of inputs that an algorithm processed, returning an output that the designer reviewed and graded to help the system improve its performance. Moreover, to achieve impressive results in data interpolation (StyleGAN) or domain transfer (CycleGAN), several architects now utilize Generative Adversarial Networks (GANs) [3, 4]. Thanks to the aforementioned AI-based models, architectural design stages that require a lot of effort can be produced much more quickly in a computer environment.

Studies on the integration of AI into architectural design have evolved and expanded over time. In 2020, [5] evaluated the contributions of AI to the interior architecture design process, revealing how designers interact with AI in the analysis and synthesis stages. In the same year, [6] tested the production of architectural plan layouts using Palladian patterns through a GAN-based approach, demonstrating the model's potential to replicate traditional form logic. In 2023, [7] combined generative design techniques with AI to generate alternative spatial fictions, focusing on the aesthetic implications of digital tools in conceptual design. That year, [8] conducted an empirical study with architecture students using DALL-E, Midjourney, and Stable Diffusion, concluding that while such tools accelerate visual ideation, they also raise concerns about authorship and creative control.

In 2024, the research focus expanded to include cultural heritage and urban-scale applications. A study on Traditional Turkish Houses explored the accuracy of AI-generated visualizations from textual prompts, particularly in capturing vernacular architectural features [9]. İznik tile compositions, utilizing generative models, are reinterpreted, demonstrating how AI can bridge traditional ornamentation with contemporary interior spaces [10]. Text-to-image models are used for reconstructing historical architecture [11], while a transformation workflow is introduced for conventional Chinese architecture using diffusion-based tools [12]. On the urban scale, a comprehensive scoping review on the role of generative AI in urban digital twins is provided [13], emphasizing the autonomous generation of 3D city models and urban scenarios. ControlCity is proposed [14] as a multimodal diffusion framework for accurate urban form generation, as well as GeminiFusion [15]. This multimodal fusion architecture enhances image quality in generative vision transformers.

Scholarly attention has increasingly turned toward integrating AI models with regulatory, historical, and sustainability-oriented design contexts. DALL-E, Midjourney, and Stable Diffusion have been compared across various architectural tasks, highlighting their performance in traditional and modern contexts [16]. A stable diffusion-based framework is offered for automatically generating historical facades in urban renewal projects [17]. Generative spatial AI has been studied for sustainable smart cities, proposing a flow model to align AI-generated urban designs with environmental and spatial logic [18]. Most recently, the effects of AI on architectural education have been addressed, providing a comprehensive analysis of the role of these technologies in pedagogical transformation and their impact on students [19].

This chronological trajectory reflects a maturing research landscape: from early-stage conceptual use of AI tools in design ideation to the development of context-aware, regulation-sensitive, and culturally anchored generative methodologies. These developments position AI not merely as a visual assistant but increasingly as a co-creator embedded in the spatial, historical, and technical dimensions of architectural practice.

Following this trajectory, the development of multimodal generative AI tools has marked a critical turning point in architectural design research. Among these, DALL-E enabled the generation of coherent visual representations directly from natural language prompts [20]. Its successor, DALL-E 2, released in 2022, further enhanced visual fidelity and introduced inpainting features, allowing users to edit parts of images based on semantic input [21]. Most recently, DALL-E 3, launched in late 2023, introduced significant improvements in prompt comprehension, spatial consistency, and semantic alignment [22]. Crucially, its native integration with GPT-4 allows for nuanced interpretation of complex architectural language, significantly reducing the need for prompt engineering [23]. These advancements position DALL-E not only as a visual tool but as a potential co-designer in early-stage architectural workflows, especially when regulatory and morphological constraints are involved.

In this context, the present study investigates how DALL-E—particularly in its latest iteration—can be utilized to generate both traditional and modern architectural visuals in alignment with the Kızılköy Conservation Master Plan. Our work moves beyond aesthetic experimentation to assess compliance, typological consistency, and design feasibility in heritage-regulated environments. The main contributions of this study are outlined as follows:

- i. This paper provides an examination of the conservation master plan and survey for Cumhuriyet Street in Kızılköy, Türkiye.
- ii. The study introduces a novel prompt engineering strategy explicitly aligned with a conservation master plan, embedding zoning, typological, and material constraints into DALL-E-compatible textual inputs.
- iii. It proposes a five-criteria evaluation model derived directly from the Kızılköy Conservation Master Plan, offering a replicable framework for assessing AI-generated designs in heritage-sensitive zones.
- iv. The research demonstrates a two-phase generation process—first reconstructing traditional architectural elements, then generating modern alternatives—while maintaining formal coherence with the regulatory context.
- v. This paper is one of the first empirical studies to assess how a general-purpose AI model, such as DALL-E 3, performs under architectural code constraints, thereby contributing to the emerging literature on AI in architecture.
- vi. The findings reveal that generative AI, when guided by regulation-aware prompts, can be effectively used not only for speculative design but also for visualizing contextually and legally valid proposals in conservation areas.
- vii. The traditional textures and designs created by DALL-E according to the conservation master plan and survey are presented.
- viii. The modern designs produced by DALL-E, as outlined in the conservation master plan and survey, are offered.

The rest of the paper is organized as follows: Section 2 details the identification and analysis of the structures in the study area, Kızılköy. It then presents the conservation master plan of the study area. Section 3 proposes prompt templates for DALL-E to create traditional textures and modern designs of the area and presents the results generated by DALL-E, respectively. Section 4 analyzes the visual results and critically examines DALL-E's capabilities and limitations, focusing on how its architectural structure and varying prompt

formulations affect output quality and compliance with conservation requirements. The final section discusses the results and DALL-E for future studies, providing conclusive remarks.

2. Materials and Methods

Firstly, a settlement with a traditional architectural structure is identified in the study. On-site inspections were carried out in this area. Plans and elevation views of ten registered structures with similar characteristics are taken, designed, and their architectural features are digitized using conventional systems to determine standard architectural features. These features are defined in the systematic prompt templates, ranging from simple to complex, in DALL-E. The outputs were compared with existing data in the traditional structure to obtain simulations that closely resemble the traditional architectural structure. Finally, modern architectural design simulations compatible with traditional architectural structures are produced using DALL-E, incorporating protection-oriented zoning regulations and outputs specific to the region's existing traditional structures.

2.1. Identification and Analysis of Structures in the Area

Upon examination of 10 structures on Cumhuriyet Street in Kıyıköy (Figures 1 and 2), it was observed that the ground floor is generally used for commercial purposes. The ground floor usually contains a kitchen, at least one room, or a shop. 90% of the structures have an entrance hall. The usage rate of wet spaces on the ground floor is 75%. It was found that 50% of the structures have three doors, with a length-to-width ratio of 2/3, and more than six windows, with a height-to-width ratio of 2/3. On the first floor, there are more than ten windows with a ratio of 1/2. 86% of the structures have three rooms. The structures with wet spaces on the first floor constitute 80% of the total.

Masonry or wooden frame construction systems are used. One of the structures is made of bricks and plastered. Sequential or lath wooden cladding is used on the exterior. Ground-floor windows are relatively larger than upper-floor windows. The upper-floor windows are thin and long. Shop entrances and upper-floor entrances are provided through different doors. Shutters were found in shops used for commercial purposes. Sash windows were used. Two rows of iron railings can be found on the upper floors. Wooden eaves and brick coping were used for roofs. The structure at parcel 201/3 has wooden beams with 10 cm wooden sills. Consoles are present on the first floor. The data obtained from the field research is used to create a general rule.



Figure 1. Photos of Traditional Housing in Kıyıköy

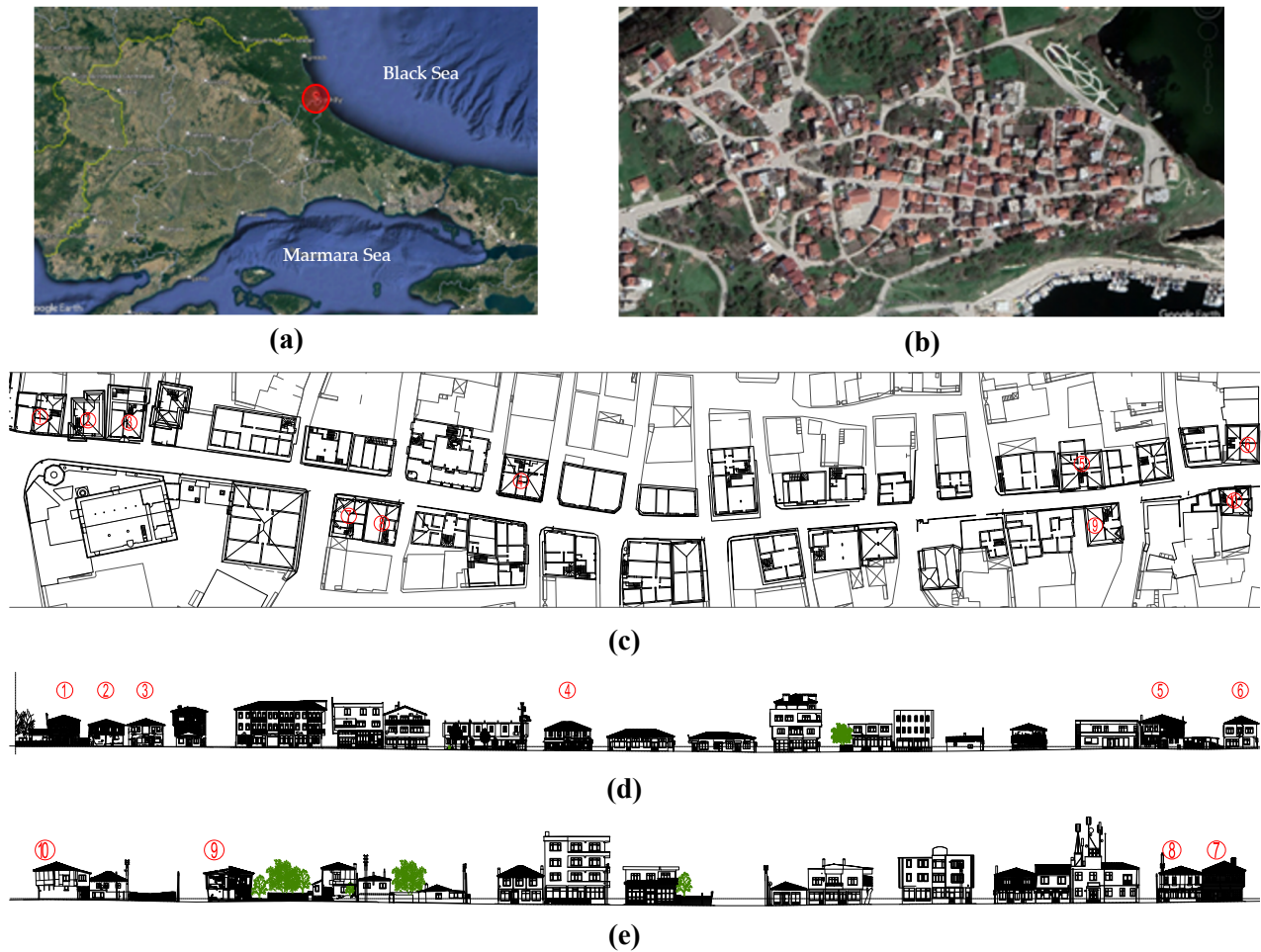


Figure 2. (a) Location of Kıyıköy [24], (b) Satellite image of Kıyıköy Town [24], (c) Kıyıköy Cumhuriyet St. Site Plan [12], (d) Kıyıköy Cumhuriyet St. North Silhouette [25], (e) Kıyıköy Cumhuriyet St. South Silhouette [25]

2.2. Kıyıköy Conservation Master Plan

The High Council for the Conservation of Cultural and Natural Assets, in all matters related to the official, religious, and civil architectural examples, which are located in the Kıyıköy urban protected area and deemed necessary to be protected by the decision of the Edirne Cultural and Natural Heritage Preservation Board dated May 13, 1988, and number 7. Its conclusion, dated May 21, 1990, and numbered 21, is valid. For new constructions in the parcels adjacent to the registered buildings within the Kıyıköy urban site area, a construction permit must be obtained from the Edirne Conservation Board. This construction must be constructed within the framework of the conditions subject to permission (Tables 1 and 2). Its depth should be a maximum of 12m. The minimum facade of the building is 6 m. The building arrangement must be separate, and the decision to leave the front garden is at your discretion.

Suppose there is a situation adjacent to an empty parcel from both sides. In that case, although the building arrangement is separated, it can be contiguous, or if a formation is adjacent to an empty parcel from one side, a twin arrangement can be made. Neighborhood distances between buildings are 3 m. Still, the length of the parcel facade outside the drawing distances is minimal. If it is less than the building facade conditions, the side pulling distance can be reduced to 2 m. The floor height is 6.50 m for two floors and 9.50 m for three. The ground floor height cannot exceed 3.50 m. The lowest floor height is calculated by measuring from the floor to the top of the floor and is 2.40 m. The tile cover should be made with a cradle or broken roof. No building can be built without eaves, and the eaves width cannot exceed 0.50 m. Terrace roofs and mezzanine floors are

not allowed. Wooden material, whitewash, or white plaster is used as an exterior material. Entire window and door openings on facades cannot exceed 30% of the facade area.

Windows should be rectangular with the short side horizontal. The ratio of height to width in a rectangle should be at least $\frac{1}{2}$. Entrance doors should be in the form of a rectangle with the short side horizontal. The horizontal distance between the opposite bay windows of the buildings facing the street cannot be less than 3.50 m. Ascents start from the first floor and cannot exceed 0.50 m. The overhangs must be closed at the front and should not exceed $\frac{2}{3}$ of the length of the front. Open or closed exits can be made on the rear and side facades, provided the exact dimensions and conditions are valid. Closed overhangs cannot approach the neighboring parcel border more than 3.00 m, and open overhangs cannot approach more than 2.00 m.

Table 1. Characteristics of proprietary buildings

No	Parcel No	Facade (Ground Floor)				Facade (First Floor)			Plan	
		Number of Doors	Door Size	Number of Windows	Window Size 1	Window Size 2	Number of Windows	Window Size	Width	Length
1	227-3	3	128x256	5	110x185	140x175	12	90x180	7.40	10.50
2	227-4	2	170x260	3	75x90	N	16	56,5x113	8.50	11.20
3	227-7	3	125x250	6	81x137	130x137	8	65x120	8.50	13.20
4	219-1	5	115x240	10	130x190	N	15	63x109	11.20	10.40
5	202-3	3	190x225	8	63x109	N	12	80x160	10.70	9.30
6	201-3	2	195x200	4	123x180	N	4	132x240	8.10	9.35
7	223-1	3	105x230	6	140x155	N	16	88x176	8.10	10.10
8	223-2	3	100x220	4	108x146	155x225	9	75x150	8.65	10.25
9	204-10	1	168x220	8	80x160	N	8	80x160	8.50	10.00
10	203-3	2	90X220	3	130x260	N	4	150x300	7.40	10.50

Table 2. Characteristics of proprietary buildings

No	Parcel No	Ground Floor								First Floor					
		Kitchen	Shop 1	Shop 2	Shop 3	Room 1	Room 2	Room 3	Wet area (WC-Bathroom)	Entrance hall	Storage	Room 1	Room 2	Room 3	Wet area (WC-Bathroom)
1	227-3	✓	✓			✓			✓	✓	✓	✓	✓	✓	✓
2	227-4		✓							✓	✓	✓	✓	✓	✓
3	227-7		✓	✓						✓	✓	✓	✓	✓	✓
4	219-1	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓
5	202-3	✓				✓	✓	✓	✓			✓	✓	✓	✓
6	201-3	✓				✓	✓			✓		✓	✓	✓	✓
7	223-1	✓	✓	✓						✓		✓	✓	✓	✓
8	223-2		✓	✓						✓		✓	✓	✓	✓
9	204-10	✓				✓			✓	✓		✓	✓	✓	
10	203-3	✓	✓			✓	✓			✓					

3. Creation of Traditional Texture Modern Design Utilizing DALL-E

This section presents prompt templates for creating traditional and modern texture designs for Kızılköy using DALL-E. Afterwards, it provides AI-based design for Kızılköy.

3.1. Creation of the traditional texture for Kızılköy utilizing DALL-E

In this subsection, a prompt template for DALL-E is suggested to create traditional textures, as outlined in the plan in Table 3. The elements of the prompt template are “housing type-color-material”, “facade material”, “ground floor size”, “ground floor window feature”, “first floor size”, “location”, “desired representation”, and “number and feature of windows”.

Table 3. The prompt templates and properties for traditional texture via DALL-E

Prompt template	Housing type-color-material + Facade material + Ground floor size and ground floor window feature + First floor size + Location + Desired representation + Number and feature of windows
Prompt Element	Alternative to the Traditional Texture
Housing type-color-material	traditional ottoman brown wooden house with bay window
Facade material	<i>i.</i> wood veneer of the facade <i>ii.</i> whitewash <i>iii.</i> white sprinkling plaster
Ground floor and ground floor window feature	<i>i.</i> ground floor size $8.50 \times 10.50 \times 3.50$ meters, and Windows with brown shuttered <i>ii.</i> ground floor size is $8.50 \times 10.50 \times 3.50$ meters <i>iii.</i> clam stone of ground floor.
First floor size	<i>i.</i> dark walnut wooden mansion first floor <i>ii.</i> wooden mansion first floor <i>iii.</i> upstairs $9.50 \times 11.50 \times 3.00$ meters
Location	Kızılköy in Kırklareli in Türkiye
Desired representation	<i>i.</i> architectural rendering <i>ii.</i> 3D view
Number and features of windows	<i>i.</i> eight Windows <i>ii.</i> Four windows of every facade and guillotine Windows

Figure 3 presents a series of visual outputs generated by DALL-E based on prompt templates that describe traditional architectural elements found in Kızılköy. The goal of this figure is not to assess the model’s ability to replicate vernacular architecture but to demonstrate how increasing prompt specificity and complexity affects the visual accuracy and architectural richness of the AI-generated images (Figures 3a-3e). As the prompts evolve from simple, schematic descriptions to more detailed and semantically structured formulations, the resulting images exhibit greater alignment with traditional architectural features, such as material variation, façade rhythm, and proportional articulation. Since most upcoming architectural projects in Kızılköy will follow modern design approaches within the constraints of the conservation master plan, the focus of this study shifts accordingly to the creation and evaluation of modern architectural proposals, which are discussed in the next section.

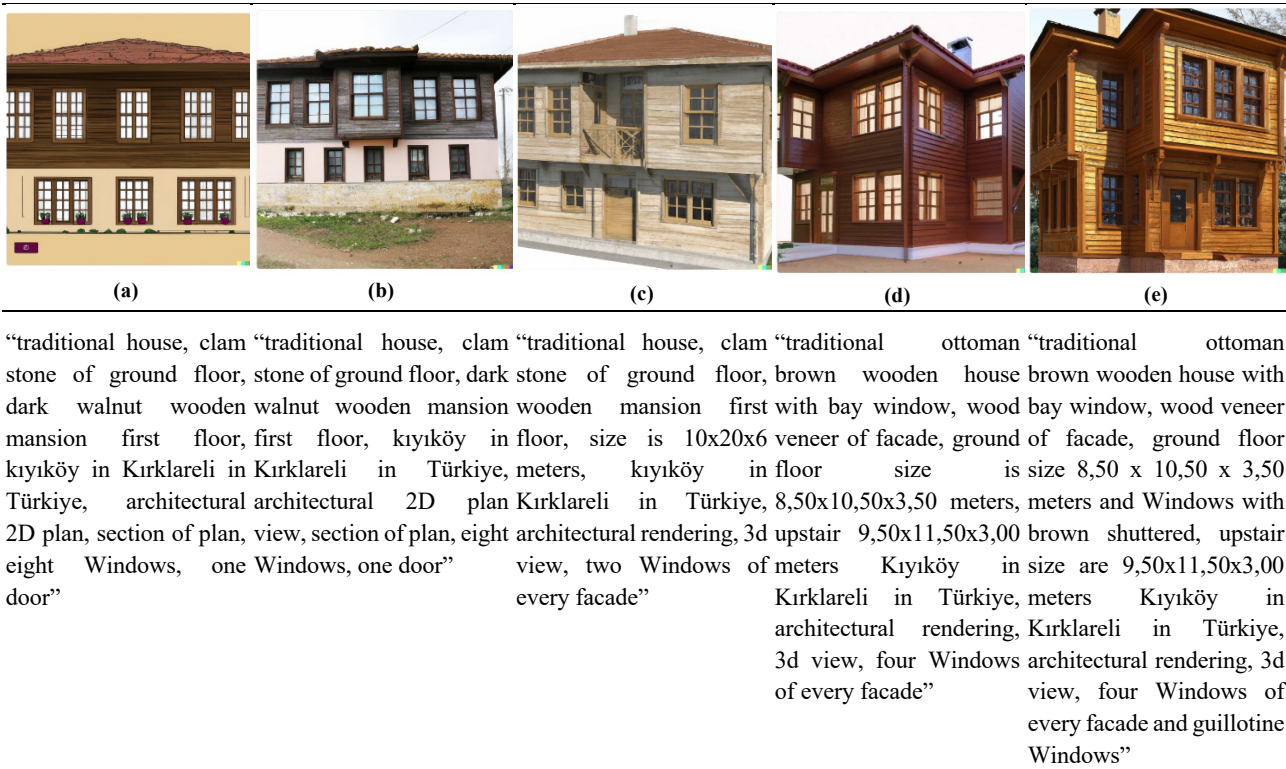


Figure 3. Visual outputs of the prompt templates for traditional textures in Kıyıköy

3.2. Creation of the modern designs for Kıyıköy utilizing DALL-E

In this subsection, a prompt template for DALL-E is offered to create modern designs, as outlined in Table 4. The elements of the prompt template are “housing type”, “ground floor size”, “prominent feature of the first floor”, “floor height”, “roof material and features”, “roof eaves width”, “facade material”, “window length-width ratio”, and “entrance door shape”. Secondly, a result of the prompt template for DALL-E to create a modern design, as presented in the plan, is shown in Figure 4.

Table 4. The prompt templates and properties for modern design via DALL-E

Prompt Template	Housing type + Ground floor size + Prominent feature of the first floor + floor height + roof material and features + Roof eaves width + facade material + window length-width ratio + entrance door shape
Prompt Element	Alternative for the Modern Design
Housing type	modern house
Ground floor size	ground floor size is 8.50x10.50x3.00 meters.
A prominent feature of the first floor	bay window on the first floor
Floor height	floor height is 6.50 m for two floors
Roof material and features	tile cover is a cradle or hipped roof
Roof eaves width	i. wooden facade or white paint ii. wood veneer of the facade iii. whitewash iv. white sprinkling plaster
Facade material	windows height-to-width ratio is $\frac{1}{2}$
Window length-width ratio	entrance doors are rectangular
Entrance door shape	windows height-to-width ratio is $\frac{1}{2}$

Figure 4 displays four architectural visualizations generated by DALL-E 2 and DALL-E 3, based on a structured prompt that integrates specific spatial and morphological requirements from the Kıyıköy Conservation Master Plan. All outputs effectively reflect the general volumetric constraints and roof typologies dictated by the plan, with consistent adherence to two-storey height, hipped or cradle roof forms, and appropriate eave depth. The use of white plaster or wooden cladding in the facades aligns well with material guidelines. While the bay window element is represented in the DALL-E 3 outputs (Figures 4c and 4d) with greater geometric accuracy and material coherence, some inconsistencies remain, particularly in the interpretation of window proportions and surface openness. In several images, the ratio or placement of fenestration does not fully capture the intended balance between traditional rectangular forms and the mandated threshold of openness. Nonetheless, these visualizations collectively illustrate the model's ability to interpret and synthesize multi-constraint architectural directives, predominantly when guided by a precise and conservation-oriented prompt structure.



Figure 4. Visual outputs by (a) DALL-E 2, (b) DALL-E 2, (c) DALL-E 3, and (d) DALL-E 3 of the prompt template “modern house, ground floor size are $8.50 \times 10.50 \times 3.00$ meters, bay window in first floor, floor height is 6.50 m for two floors, tile cover is cradle or hipped roof, eaves width is 0.50 m, wooden facade or white paint, windows height-to-width ratio is $\frac{1}{2}$, entrance doors are rectangular” for modern design

Table 5 presents a comparative evaluation of four architectural visualizations generated by DALL-E, each structured according to the spatial, morphological, and material constraints outlined in the Kıyıköy Conservation Master Plan. The table assesses these outputs based on five regulatory criteria: building height and number of stories, minimum facade width and distance to neighbors, roof typology, exterior material compatibility, and the geometric and proportional conformity of windows and doors. As shown, Figure 4b

fully meets all five criteria (100% compliance), while Figures 4a, 4c, and 4d each achieve four out of five conditions (80% compliance). The consistent shortcoming in the latter three figures is their failure to adhere to the proportions of windows and doors, specifically regarding the rectangular form, the $\frac{1}{2}$ ratio, or the total opening surface exceeding 30%. These results demonstrate that when guided by well-defined conservation parameters, DALL-E can produce architectural visuals that align with regulatory design expectations; however, certain precision-dependent features, such as fenestration ratios, remain susceptible to inconsistency. This highlights the importance of prompt calibration and semantic control when deploying generative AI in heritage-oriented design scenarios.

Table 5. Evaluation of Design Outputs According to Kızılköy Conservation Plan Criteria

Criteria No	Success Criteria According to the Conservation Plan	Figure 4a	Figure 4b	Figure 4c	Figure 4d
1	Height (Storey) Is the total number of storeys and the height of each storey appropriate? (For example, two storeys: 6.50 m, minimum 2.40 m)	✓	✓	✓	✓
2	Facade (Distance) Is a width of at least 6 m and a neighboring distance of 3 m provided? (can be reduced to 2 m)	✓	✓	✓	✓
3	Roof Is the roof type appropriate? (Roofing or hipped, eaves 0.50 m)	✓	✓	✓	✓
4	Exterior Is the material appropriate? (wood, white plaster, whitewash)	✓	✓	✓	✓
5	Windows and Doors Are they rectangular, and is the ratio at least 1/2? Does the total opening exceed 30%?	✗	✓	✗	✗
Total		80 %	100 %	80 %	80 %

4. Discussion

The integration of generative AI tools, such as DALL-E, into architectural workflows opens up new possibilities for context-sensitive design, especially in regulated environments like heritage zones. This study explored the model's capabilities through the Kızılköy Conservation Master Plan—a regulatory framework that imposes strict morphological and material constraints on new developments. Findings indicate that when guided by carefully structured prompts based on zoning, material, and spatial rules, DALL-E can generate outputs that visually and formally align with conservation principles.

Recent studies support this potential. For example, in [17], a diffusion-based framework has been proposed for automating the generation of historic building facades in urban renewal projects, emphasizing the importance of regulatory compliance and material authenticity. Similarly, in [10], it has been demonstrated how generative models could reinterpret traditional İznik tile patterns within modern interior designs, providing a precedent for culturally embedded visual generation using AI tools. Our approach builds on these findings by explicitly operationalizing compliance criteria derived from the conservation plan (e.g., height restrictions, roof geometry, and facade materials), thus offering a replicable and regulation-driven prompt methodology.

However, unlike domain-specific design tools, such as BIM-integrated or digital twin-based systems, general-purpose models like DALL-E still lack embedded architectural reasoning. For instance, [13] highlights how generative AI in urban digital twins promotes spatial data coherence across models and representations, a capability that DALL-E does not inherently possess. Similarly, [14] introduced ControlCity, a multimodal diffusion model that captures urban morphology with high geospatial fidelity—something that current text-to-image models struggle to replicate in plan-view consistency or volumetric logic.

In our case, this limitation was mitigated through a modular prompt strategy, breaking down architectural features into discrete components (e.g., roof type, window proportions) for controlled synthesis. Yet, outputs still required manual validation to ensure plan-level coherence and material continuity. This echoes the findings of [11], who found that even state-of-the-art models tend to produce visually coherent yet structurally inconsistent reconstructions in heritage restoration workflows.

Another critical insight was the role of prompt specificity. The fidelity and contextual accuracy of outputs varied significantly with prompt clarity and syntactic precision—a conclusion aligned with [12], who demonstrated how controlled transformation pathways are essential when working with traditional architectural grammars using diffusion models. This is further supported by [8], who conducted user-based experiments and reported that more structured prompts yield outputs that align more closely with the intended design semantics.

While our study focused on image-based outputs, the broader architectural design process demands multi-representational consistency (plans, sections, material schedules). Therefore, DALL-E's utility currently remains within the conceptual ideation phase. However, future developments—especially in multimodal architectures—suggest that this gap may close. For example, [15] introduced GeminiFusion, a vision transformer with pixel-wise fusion designed for improved semantic alignment across modalities, laying the foundation for more spatially aware generative frameworks.

Finally, models such as [16] illustrate that text-to-image AI can perform meaningfully across both traditional and modern styles, provided that architectural semantics are embedded in the prompts. More broadly, [18] argue that spatial intelligence in AI must evolve toward sustainability-aware urban design, pushing generative systems to consider contextual, environmental, and regulatory dimensions simultaneously.

In summary, this study confirms that AI-generated visual content, when grounded in policy-aware prompt frameworks, holds significant potential to support architects in heritage-sensitive contexts. However, fully realizing this potential will require domain-adapted training data, spatial reasoning capabilities, and deeper integration with architectural knowledge systems.

5. Conclusion

This study evaluated the potential of DALL-E as a generative design tool for creating both traditional and modern architectural representations compliant with the Kızılköy Conservation Master Plan. Rather than relying on generic image quality metrics such as SSIM [26], which are inadequate for assessing regulatory compliance, we developed a five-criterion evaluation framework directly derived from the conservation plan. The outputs were evaluated based on building height, facade materials, setback distances, roof typologies, and window/door proportions. Our findings reveal that DALL-E, when guided by regulatory-specific and structurally organized prompts, can produce designs that partially or fully meet the conservation requirements.

The results affirm DALL-E's potential in early-stage architectural ideation, especially within constrained regulatory contexts. Traditional architectural textures could be accurately visualized, while modern designs exhibited a notable degree of compliance, particularly in formal and material dimensions. Nonetheless, the tool's lack of architectural spatial reasoning—such as floor plan consistency and structural coherence—limits its application beyond the conceptual phase.

The limitations of this study include DALL-E's black-box nature, its lack of control over architectural hierarchies, and the dependence on textual prompt clarity for successful outputs. Moreover, the evaluation process was conducted manually, which, while contextually grounded, introduces a level of subjectivity. Automating rule-checking through computer vision or integrating with GIS data could strengthen future assessments.

Future research should focus on fine-tuning generative models using annotated architectural datasets specific to vernacular typologies and conservation codes. Additionally, hybrid workflows integrating DALL-E with CAD/BIM systems may provide more usable outputs for architectural practice [27]. Exploration of emerging text-to-3D or plan-aware generative models may also overcome current volumetric limitations, supporting the development of AI tools capable of generating complete, context-sensitive architectural designs [28].

Ultimately, this research contributes to the growing intersection of AI and architectural design by demonstrating a structured, policy-aware methodology for evaluating generative outputs. As such technologies evolve, their effective integration into conservation-sensitive design practices may provide architects and planners with powerful new tools for balancing innovation with heritage preservation.

Author Contributions

The first and second author conceptualized the study, designed the methodology, and conducted the investigation. The second author was responsible for data curation and visualization. The first author contributed to the method, participated in the investigation, and played a crucial role in the writing, review, and editing process. The third author was involved in conceptualization and methodology and contributed to the preparation of the original draft and visualization. The second author secured funding for the project. The first and second author have critically reviewed the final version of the manuscript. They all read and approved the final version of the paper.

Conflict of Interest

All the authors declare no conflict of interest.

Ethical Review and Approval

No approval from the Board of Ethics is required.

Acknowledgment

We thank Kıyıköy Municipality for providing the notes of the conservation master plan of Cumhuriyet Street in Kıyıköy, Türkiye.

References

- [1] S. Seneviratne, D. Senanayake, S. Rasnayaka, R. Vidanaarachchi, J. Thompson, *DALLE-URBAN: Capturing the urban design expertise of large text to image transformers*, International Conference on Digital Image Computing: Techniques and Applications (DICTA), IEEE, Sydney, 2022, pp. 1–9.
- [2] M. S. Watanabe, *Algorithmic Design/Induction Design: Three Kinds of Flow/Three Stations* (2005), <https://www.makoto-architect.com/kashiwanohaCSt.html>, Accessed 23 Feb 2023.
- [3] I. Goodfellow, J. Pouget-Abadie, M. Mirza, B. Xu, D. Warde-Farley, S. Ozair, A. Courville, Y. Bengio, *Generative adversarial nets*, Advances in Neural Information Processing Systems 27 (2014) 1–9.
- [4] D. Bolojan, *The Hitchhiker's Guide to Artificial Intelligence: AI and Architectural Design* (2021), www.digitalfutures.world, Accessed 23 Feb 2023.
- [5] B. Yıldırım, D. Demirarslan, *Evaluation of the benefits of artificial intelligence applications to the design process in interior architecture*, Humanities Sciences 15 (2) (2020) 62–80.

- [6] C. Uzun, M. B. Çokaloğlu, A. İnceoğlu, *GAN as a generative architectural plan layout tool: A case study for training DCGAN with Palladian Plans, and evaluation of DCGAN outputs*, ITU Journal of the Faculty of the Architecture 17 (2) (2020) 185–198.
- [7] B. Sağlam, T. Çelik, *Architecture and utopia: Experiments in generative design with artificial intelligence*, Mimarlık, 429 (2023) 59–64.
- [8] V. Paananen, J. Oppenlaender, A. Visuri, *Using text-to-image generation for architectural design ideation*, International Journal of Architectural Computing 22 (3) (2024) 458–474.
- [9] A. Durukan, R. D. Türk, *The effect of verbally transmitted data on visualisation potential in artificial intelligence perception: Traditional Turkish house example*, International Journal of Social and Humanities Sciences Research, 10 (102) (2023) 3569–3580.
- [10] M. Gür, F. K. Çorakbaş, İ. S. Atar, M. G. Çelik, İ. Maşat, C. Şahin, *Communicating AI for architectural and interior design: Reinterpreting traditional Iznik tile compositions through AI software for contemporary spaces*, Buildings 14 (9) (2024) 2916.
- [11] K. Arzomand, M. Rustell, T. Kalganova, *From ruins to reconstruction: Harnessing text-to-image AI for restoring historical architectures*, Challenge Journal of Structural Mechanics 10 (2) (2024) 69–85.
- [12] Y. Lu, J. Wu, M. Wang, J. Fu, W. Xie, P. Wang, P. Zhao, *Design transformation pathways for AI-generated images in Chinese traditional architecture*, Electronics 14 (2) (2025) 282.
- [13] H. Xu, F. Omitaomu, S. Sabri, S. Zlatanova, X. Li, Y. Song, *Leveraging generative AI for urban digital twins: a scoping review on the autonomous generation of urban data, scenarios, designs, and 3D city models for smart city advancement*, Urban Informatics 3 (1) (2024) 29.
- [14] F. Zhou, H. Li, R. Hu, S. Wu, H. Feng, Z. Du, L. Xu, *ControlCity: A Multimodal Diffusion Model Based Approach for Accurate Geospatial data Generation and Urban Morphology Analysis* (2024), <https://arxiv.org/abs/2409.17049v1>, Accessed 22 June 2025.
- [15] D. Jia, J. Guo, K. Han, H. Wu, C. Zhang, C. Xu, X. Chen, *Geminifusion: Efficient Pixel-Wise Multimodal Fusion for Vision Transformer* (2024), <https://arxiv.org/abs/2406.01210v2>, Accessed 22 June 2025.
- [16] C. Thampanichwat, T. Wongvorachan, L. Sirisakdi, P. Chunhajinda, S. Bunyarittikit, R. Wongmahasiri, *Mindful architecture from text-to-image AI perspectives: A case study of DALL-E, Midjourney, and Stable Diffusion*, Buildings 15 (6) (2025) 972.
- [17] Z. Kuang, J. Zhang, Y. Li, T. Fukuda, *Preserving architectural heritage in urban renewal: A stable diffusion model framework for automated historical facade generation*, npj Heritage Science 13 (1) (2025) 1–19.
- [18] J. Huang, S. E. Bibri, P. Keel, *Generative spatial artificial intelligence for sustainable smart cities: A pioneering large flow model for urban digital twin*, Environmental Science and Ecotechnology 24 (2025) 100526.
- [19] S. Alaçam, O. Z. Güzelci, S. Z. Bacınoğlu, H. N. Kızılyaprak, C. Uzun, E. Coşkun, İ. Karadağ, *Artificial intelligence 101 for architectural education*, Oneri 20 (Special Issue) (2025) 219–237.
- [20] A. Ramesh, M. Pavlov, G. Goh, S. Gray, C. Voss, A. Radford, I. Sutskever, *Zero-Shot Text-to-Image Generation* (2021), <https://arxiv.org/abs/2102.12092v2> Accessed 22 June 2025.
- [21] A. Ramesh, P. Dhariwal, A. Nichol, C. Chu, M. Chen, *Hierarchical Text-Conditional Image Generation with CLIP Latents* (2022), <https://arxiv.org/abs/2204.06125v1>, Accessed 22 June 2025.
- [22] OpenAI, DALL-E 3 system card, <https://openai.com/dall-e-3>, Accessed 22 June 2025.
- [23] OpenAI, GPT-4 Technical Report (2023), <https://arxiv.org/abs/2303.08774v6>, Accessed 22 June 2025.

- [24] Google Earth, <https://earth.google.com/web/>, Accessed 20 Jan 2023.
- [25] H.Ç. Zağra Öz, *Kıyıköy Survey*, Kıyıköy Municipality, 2022, Kıyıköy, Kırklareli, Türkiye.
- [26] Z. Wang, A. C. Bovik, H. R. Sheikh, E. P. Simoncelli, *Image quality assessment: From error visibility to structural similarity*, IEEE Transactions on Image Processing 13 (4) (2004) 600–612.
- [27] J. Ko, J. Ajibefun, W. Yan, Experiments on Generative AI-Powered Parametric Modeling and BIM for Architectural Design (2023), <https://arxiv.org/abs/2308.00227v1>, Accessed 22 June 2025.
- [28] V. Liu, J. Vermeulen, G. Fitzmaurice, J. Matejka, 3DALL-E: Integrating text-to-image AI in 3D design workflows, in: D. Byrne, N. Martelaro, A. Boucher, D. Chatting, S. F. Alaoui, S. Fox, I. Nicenboim, C. MacArthur (Eds.), Proceedings of the 2023 ACM Designing Interactive Systems Conference, Pittsburgh, 2023, pp. 1955–1977.