Journal of World Architecture, 2026, Volume 10, Issue 5
https://bbwpublisher.com/journal/JWA
Online ISSN: 2208-3499
Print ISSN 2208-3480

Application of Artificial Intelligence and Virtual Reality Technologies in Architectural Design

Huiyu Deng, Bolong Yao

Tianjin University Research Institute of Architectural Design and Urban Planning Co., Ltd., Tianjin 300073, China

Copyright: © 2026 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: With the rapid development of artificial intelligence (AI) and virtual reality (VR) technologies, architectural design is gradually transforming toward visualization, intelligence, green development, and immersion. It not only boosts design efficiency but also presents design outcomes to clients in an intuitive manner, thereby improving client satisfaction with architectural design. This paper analyzes the application advantages of AI and VR technologies in architectural design, and focuses on investigating their application paths in three key links: architectural design conception, design scheme refinement, and interior design. It intends to provide references for innovations in architectural design concepts and practices, and promote high-quality development of the architectural design industry.

Keywords: Artificial intelligence technology; Virtual reality technology; Architectural design; Application paths

Online publication: November 17, 2026

1. Introduction

In the era of artificial intelligence, the pace of digital transformation in the construction industry has accelerated, putting forward higher requirements for architectural design and driving the adoption of AI and VR technologies in architectural design. AI technology can rapidly process data, including architectural surveying and mapping results and client requirements, furnishing accurate data references for designers. VR technology can construct virtual building models, intuitively demonstrate architectural structures and interior design effects, and flexibly adjust design schemes, thus enhancing the efficiency and quality of architectural design.

Therefore, architectural designers shall flexibly apply AI technologies to conceive design schemes, intelligently analyze site conditions, plot area, building orientation, local climate, and other conditions, automatically generate preliminary design schemes, and optimize schemes according to client demands to shorten design cycles. Meanwhile, designers can leverage VR technologies to build visual, immersive virtual building models, intuitively display internal building structures and interior design effects, simulate construction procedures, avert construction risks, reduce the revision rate of design and construction

schemes, and raise architectural design quality.

2. Application advantages of AI and virtual reality technologies in architectural design

2.1. Promote data sharing and break down data "isolated islands"

Architectural design involves multiple stakeholders such as designers, owners, and construction workers. However, traditional design modes can hardly realize data sharing, which frequently causes repeated revisions of construction drawings, bringing about higher project costs and construction schedule delays. AI and VR technologies facilitate data sharing among various participants, effectively solve the problem of data "isolated islands" for participating parties, and prevent deviations in design information [1].

Equipped with powerful data analysis and judgment capabilities, AI technology can analyze data concerning terrain, meteorology, and building material performance, assisting architectural designers in clarifying owner requirements and completing design conceptions. VR technology can convert two-dimensional construction drawings into virtual models, intuitively present building appearances, internal structures, and interior design renderings, advance data sharing and communication among owners, designers, and constructors, enable opinion exchange among all participating parties, and gradually refine construction drawings to achieve better design results.

2.2. Improve design efficiency

AI technology helps designers collect design cases matching project requirements, clarify design styles, functional demands, and design specifications. It makes use of intelligent architectural design models to automatically generate preliminary architectural design schemes, which are then adjusted according to project requirements, so as to effectively improve design efficiency.

In addition, designers can utilize VR technologies to adjust design schemes, modify design styles and interior decoration details in accordance with owner requirements, and update building models in real time. This practice enables designers to detect and rectify design deficiencies in a timely manner and allows owners to view design outcomes at the earliest opportunity. It avoids repeated manual drawing of construction drawings and renderings, saves substantial time, and therefore improves architectural design efficiency [2].

2.3. Improve design quality

Designers can employ AI technology to analyze design schemes, assess whether architectural structures, pipeline layouts, and seismic performance comply with standards, discover and tackle problems existing in design schemes in good time, and enhance the feasibility of design proposals. For instance, designers can apply AI algorithms to calculate data such as gravity loads and seismic loads, precisely work out force-bearing parameters of different components, evaluate the rationality of design schemes, and guarantee design scheme safety.

VR technology assists designers in constructing building component models, accurately analyzing whether design details such as pipeline layouts, building orientation, and daylighting design are reasonable, and scientifically adjusting design details. In this way, it elevates design quality and lays a solid foundation for subsequent construction work [3].

3. Application paths of AI and virtual reality technologies in architectural design

3.1. Application in the architectural design conception phase

3.1.1. Break mental set constraints and inspire design creativity

Designers can leverage big data and AI algorithms to collect excellent architectural design cases of diverse styles, build a digital case library, and analyze data including design concepts, functional layouts, space utilization, and interior design elements of high-quality cases. This facilitates screening of cases satisfying owner requirements and drawing design inspiration from excellent precedents [4].

AI technology enables designers to rapidly and accurately select classic cases matching owner demands, extract embedded elements such as regional culture, environmental art design, space utilization, and interior decoration design, reorganize and optimize these design elements, and automatically generate personalized design schemes. It prevents design proposals from being stereotyped and further boosts owner satisfaction with design outcomes.

For example, designers may collect neo-Chinese style design cases, identify highlights in space utilization, furniture design, environmental design, and color design, skillfully integrate traditional cultural elements, select furniture and lamps meeting owners' aesthetic demands, and rationally utilize spaces, so as to further improve the innovativeness of design conceptions.

3.1.2. Construct virtual building models and optimize design schemes

Compared with BIM models, VR technology empowers designers to convert two-dimensional construction drawings into dynamic models and comprehensively exhibit building appearances, heating, ventilation, and air conditioning (HVAC) systems, water and electricity systems, and interior decorations. It not only turns design inspirations into tangible outputs, but also detects defects in construction drawings in a timely manner and supports designers in optimizing design schemes [4].

Taking residential building design as an example, designers can create virtual models based on construction drawings to intuitively display functional zone division, wallpaper, floor surfaces, suspended ceilings, water and electricity pipeline layouts, and soft furnishing effects. By zooming in on partial model areas, they can elaborate on design details of living rooms, bedrooms, kitchens, and bathrooms, introduce the performance and environmental friendliness of various building materials to owners, and adjust virtual models promptly according to owners' feedback to perfect design schemes.

Furthermore, designers can carry out cross-departmental collaboration via VR technology. Together with HVAC engineers and structural engineers, they evaluate virtual design models, spot design deficiencies, scientifically adjust pipeline layouts and interior space utilization patterns, finalize design schemes as soon as possible, and raise cross-departmental collaboration efficiency [5].

3.2. Application in the architectural design scheme optimization phase

3.2.1. Multi-dimensional optimization of design schemes

AI technology conducts intelligent analysis on design schemes with reference to architectural design specifications, owner requirements, and designer expectations, detects existing problems, and optimizes design proposals [6].

For example, according to input architectural design specifications, interior color matching standards, ventilation and daylighting requirements, AI algorithms assess design schemes. They precisely analyze whether window opening areas guarantee indoor daylighting, whether hard and soft furnishing color

collocations are harmonious, and whether hidden safety hazards exist in pipeline layouts, assisting designers in perfecting schemes, maximizing indoor space utilization, and ensuring indoor ventilation and daylighting.

For large-scale public buildings, designers can apply AI technology to evaluate fire escape passages, space utilization ratios, and column grid layouts so as to secure structural stability and safety. For residential buildings, designers adjust interior design details including furniture placement, space partitions, and color collocations in accordance with owner requirements to improve owner satisfaction.

3.2.2. Build immersive interactive spaces to improve design quality

First, designers can import BIM models into virtual simulation systems to construct immersive architectural design experience scenarios, converting construction drawings and building models into lifelike virtual experience environments. They conduct immersive experiences of corridor widths, floor heights, indoor circulation paths, daylighting, and ventilation, detect design defects, and further polish design schemes.

For instance, designers may put on VR headsets to "walk through" virtual building models, simulate daily building usage scenarios, experience and adjust interior space layouts, functional zone division, and soft furnishing designs for more human-centered interior design. They adopt VR systems to simulate natural light and seasonal light and shadow variations, flexibly adjust window sizes, facade light transmission designs, and lamp layouts, and enhance the comfort of interior space design.

Second, designers can formulate construction schemes with AI and VR technologies, conduct collision detection for building structures, water supply and drainage systems, and HVAC systems, scientifically predict settlement risks and construction difficulties that may emerge in construction, optimize construction schemes in advance, and avoid construction rework [7].

Meanwhile, designers simulate construction workflows with VR technology, clarify construction sequences, component installation, and interior soft furnishing procedures, and cooperate with construction workers to polish construction schemes and guarantee their rationality and safety.

Taking super high-rise building design as an example, designers use VR software to simulate key working procedures, including main structure pile foundation construction, concrete pouring, steel structure installation, and pipeline laying, and present interior design effects. They define key outdoor and indoor design and construction points, provide data references for construction workers, and comprehensively enhance the quality of construction scheme design.

3.3. Application in the interior design phase

3.3.1. Clarify hard and soft furnishing design elements to meet owners' aesthetic demands

Interior design constitutes one of the core links of architectural design and serves as a vital carrier for satisfying owners' living and aesthetic demands. Therefore, designers shall apply AI and VR technologies to interior design, optimize hard and soft furnishing design approaches, satisfy owner requirements to the maximum extent, and boost owner satisfaction with design schemes [8].

For example, designers can utilize AI to calculate furniture dimensions for more reasonable furniture placement; optimize lamp layouts to meet lighting demands of dining rooms, living rooms, and bedrooms and achieve harmonious lighting effects; formulate wallpaper, curtain, and furniture color matching schemes to improve soft furnishing matching outcomes and create warm and comfortable living environments.

Moreover, designers can implement interactive design via VR technology. Within virtual design models, they adjust furniture positions and colors, curtain and lamp locations, as well as wall and floor materials.

They simulate natural light and artificial lighting effects in different time periods, then adjust lamp positions and brightness, furniture sizes, wallpaper colors, patterns of floor tiles or wood floors, and soft furnishing colors according to visual feedback, so as to realize harmonious hard and soft furnishing designs [9].

3.3.2. Optimize interior design construction schemes and improve design quality

Designers can formulate interior design construction schemes by means of VR technology, build virtual construction scenarios, and simulate working procedures such as wall base layer treatment, water and electricity pipeline laying, suspended ceiling installation, floor tiling, and soft furnishing delivery. They visualize interior construction workflows, sort out sequences of each construction link, and prevent conflicts caused by cross construction, so as to improve interior construction outcomes [10].

Supported by VR technology, designers simulate suspended ceiling installation heights, suspended ceiling shapes and lamp positions, adjust sizes and colors of floor tiles, and deliver visualized technical disclosure, helping construction workers understand design requirements, accelerate interior renovation progress, and further lift interior design quality.

In addition, designers can demonstrate interior design effects for owners with VR technology, enabling owners to intuitively perceive wall, suspended ceiling, water and electricity, floor, and various soft furnishing outcomes. They adjust soft furnishing color combinations and placements according to owner feedback, satisfy owners' living and aesthetic requirements, and thereby improve owner satisfaction.

4. Conclusion

To sum up, AI and VR technologies boast broad application prospects in the architectural design field. They can not only accurately analyze owner requirements, but also advance data sharing, raise the efficiency and quality of architectural design, better satisfy owners' personalized design demands, and enhance owners' satisfaction with design proposals.

Hence, architectural designers shall update their design philosophies, flexibly deploy AI and VR technologies, integrate the two technologies into scheme formulation, scheme optimization, and report presentation stages, and visualize interior design inspirations and workflows. They shall intuitively present design concepts concerning building structures, daylighting and ventilation conditions, space utilization and interior decoration, and adjust design schemes in response to client requirements for higher design efficiency.

In the future, architectural designers shall attempt to integrate AI, VR, and Internet of Things technologies, optimize architectural design approaches, focus on green design and humanistic care, embed traditional cultural elements into designs, promote the transformation of architectural design toward energy-saving green development and human-centered concepts, and create green, livable, culturally rich, warm and comfortable living spaces for clients.

Disclosure statement

The authors declare no conflict of interest.

References

[1] Zhang YF, Ma WW, Zhang SW, 2026, Application of AI and Virtual-Reality Technologies in Architectural Design. World Home Journal, 2026(1): 82–84.

[2] Chen TB, Wang C, 2025, Research on Optimizing the Whole Process of Architectural Design Schemes Based on Virtual-Reality Technology — A Case Study of a 24 Class Junior High-School Building in Lixian Block, Daxing District, Beijing. Architecture Technique (Chinese-English), 2025(S2): 74–76.

[3] Wang MW, 2025, Research on Application of Virtual Reality Technology in Renewal Design of Existing Buildings, thesis, Xi'an University of Architecture and Technology.

[4] Luo J, 2025, Research on Digital-Experience Design for Anshun Tunpu Buildings Based on Virtual Reality Technology. Journal of Anshun University, 27(2): 1–7.

[5] Ma ZY, Dong X, 2025, Research on Application of Virtual Reality Technology in Architectural Structural Design. Sichuan Building Materials, 51(4): 95–98.

[6] Guan QY, 2025, Application of AI and Virtual Reality Technologies in Architectural Design. Science-Technology Innovation and Application, 15(9): 5–8.

[7] Pei X, 2022, Spatial Optimization Design for Concrete Structure Buildings Based on Virtual Reality Technology. Journal of Chengdu Technological University, 25(1): 29–32.

[8] Zhong S, Lin YH, 2024, Research on Key Points of Interior Architectural Design with Virtual Reality Technology. Real-Estate World, 2024(14): 161–163.

[9] Li D, Liu HT, 2024, Research on Architectural Design and Optimization Based on AI and Virtual Reality Technologies. Science Technology Innovation and Application, 14(14): 116–119.

[10] Gao JY, 2024, Research on Application of Virtual Reality Technology in the Architectural Design Field. Housing and Real Estate, 2024(6): 157–159.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.