Research on the Application of Virtual Reality Technology under the Background of Smart Tourism

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Abstract: Driven by widespread digital restructuring across global tourism sectors, smart-oriented tourism development has become an irreversible industrial evolution trend. This study conducts targeted exploration on the practical application value and inherent limitations of virtual reality technology deployed within smart tourism scenarios. Combining documentary collation and empirical case analysis, this paper discusses the intrinsic coupling between virtual reality technology and smart tourism systems, alongside practical deployment cases focused on tourist experience upgrading and scenic digital reconstruction. Research findings verify that virtual reality tools effectively facilitate industrial digital renovation and immersive tourist perception, yet excessive deployment costs and crude scene modeling hinder large-scale industrial promotion. This work delivers actionable technical and operational references for innovative, high-quality smart tourism development.

Keywords: Smart Tourism; Virtual Reality Technology; Tourism Digital Transformation

1. Introduction

1.1 Research Background and Significance

Global tourism industries continue undergoing digital restructuring to renovate traditional operational modes and reshape end-user travel experiences. Digital-enabled renovation has rewritten the inherent operational logic of conventional tourism businesses, pushing basic sightseeing and standardized service models toward intelligent customization and immersive experiential development. Modern tourism consumers hold diverse and personalized expectations for travel services. Basic scenic sightseeing and unified service provision can no longer satisfy experiential and emotional demands among contemporary travelers. Continuous penetration of digital technologies creates new developmental opportunities for iterative upgrading across the whole tourism industry.

Smart tourism construction integrates diverse digital tools to achieve digitized scenic resource reconstruction, intelligent venue administration and customized tourism service delivery. Among existing digital technical solutions, virtual reality technology boasts unique immersive simulation capabilities suitable for tourism scenario iteration. The technology reconstructs authentic tourist landscapes within digital environments, breaking geographical and temporal constraints that limit offline tourism activities. It also assists tourism operators in resource exhibition, destination brand promotion and user experience iteration. Frontline industrial practitioners consistently explore feasible integration schemes between virtual reality tools and local tourism scenarios to resolve display deficiencies and low user engagement embedded within traditional tourism operations.

The research delivers dual values covering academic exploration and industrial practice. In theoretical terms, it supplements targeted research outcomes regarding digital simulation technology application within smart tourism contexts. Existing academic works prioritize macro policy interpretation and industrial digital trend analysis, with limited targeted discussion on practical application rules and technical defects of virtual reality tools. This research enriches the theoretical framework of digitally empowered smart tourism development. Practically, it addresses prevalent operational pain points during tourism digital transformation. Mature, stable virtual reality deployment models assist tourism enterprises in mitigating offline operational pressure, expanding online service coverage and strengthening core market competitiveness within digital economic ecosystems.

1.2 Overview of Domestic and Foreign Research Status

Overseas academic exploration of virtual reality adoption in smart tourism emerged earlier and has formed relatively mature research frameworks. Foreign scholars devote extensive research efforts to technical iteration, user experience assessment and sustainable developmental value of virtual tourism scenarios. Relevant studies investigate how immersive digital environments reshape tourist perceived value and travel decision-making tendency, confirming the effectiveness of virtual reality tools in destination branding and cultural heritage resource preservation. Most overseas research incorporates classic technology acceptance theories to interpret user behavioural intention toward virtual tourism products, offering quantitative empirical support for scenario optimization and product upgrading. Industrial surveys also prove that virtual tourism services ease overcrowding pressure on physical scenic spots, supporting long-term sustainable operation of tourism destinations.

Domestic research on smart tourism and virtual reality deployment expands steadily alongside national cultural tourism digital upgrading initiatives. Local academic outputs focus heavily on practical scenario cases and industrial developmental countermeasures. Researchers explore virtual reality application effects within heritage tourism, scenic promotion and digital museum exhibitions. Although local literature accumulates abundant case-based research results, systematic induction of technical flaws and long-term operational dilemmas remains scarce. Most domestic studies merely introduce practical scenarios and put forward superficial developmental suggestions, lacking targeted, implementable schemes for technical optimization and industrial operational improvement. In-depth theoretical modeling and empirical verification require further supplementation.

Synthetic review of global literature verifies virtual reality as a fundamental supporting technology for modern smart tourism development. Nevertheless, academic communities lack systematic research covering technical adaptability, scenario matching efficiency and long-term commercial operational mechanisms. This study targets such research gaps to conduct targeted, practical exploration.

1.3 Research Content and Methods

This paper's research scope covers theoretical framework collation, practical status investigation, existing defect analysis and developmental strategy design. The research firstly organizes core definitions and theoretical foundations related to smart tourism and virtual reality technology, clarifying technical features and industrial adaptability. It then summarizes mainstream virtual reality deployment scenarios within current smart tourism ecosystems through industrial investigation and literature collation. Key restrictive factors limiting technology popularization and industrial landing are summarized via inductive analysis. Optimized industrial solutions matching contemporary tourism developmental characteristics are proposed to facilitate steady, sustainable deployment of virtual reality technology in smart tourism construction.

Two standard academic research approaches are adopted throughout this research. Documentary collation collects and categorizes global journal papers, industrial investigation reports and technical specifications focusing on smart tourism and virtual reality deployment. Sorting of existing literature clarifies current research progress and unresolved academic gaps, establishing solid theoretical foundations for subsequent analysis. Empirical case analysis selects representative domestic and overseas scenic spots and digital tourism projects adopting virtual reality technology as research samples. Evaluation of practical deployment effects, operational obstacles and technical deficiencies relies on project operational data and public industrial feedback, ensuring that research conclusions and optimized strategies fit real industrial operational rules.

2. Theoretical Basis of Related Concepts and Technologies

2.1 Core Concepts and Development Characteristics of Smart Tourism

Smart tourism represents an innovative industrial development paradigm that leverages modern digital information tools to realize intelligent resource perception, efficient scenic administration and precise tourism service delivery. This developmental model integrates local tourism resource endowments, internet digital technologies and modern service concepts

to renovate conventional tourism industrial chains, achieving comprehensive upgrades in administrative efficiency, tourist experiential quality and industrial economic returns. Smart tourism covers full industrial links including resource management, scenic operation, tourist reception and destination branding, running through the entire lifecycle of modern tourism business operations.

Smart tourism demonstrates distinctive developmental attributes within current digital economic environments. Intelligent administration constitutes its basic operational feature. Diverse digital sensing and monitoring tools support scenic administrators in real-time passenger flow supervision, resource scheduling and equipment status inspection, cutting manual administrative expenditure and boosting operational efficiency. Customized service provision acts as the core developmental attribute of modern smart tourism. Digital operational platforms record user travel preferences and consumption habits, enabling tourism operators to deliver tailored travel schemes and exclusive service content for diversified consumer groups. Digital scenario reconstruction serves as a crucial developmental direction, converting physical tourism resources into digital assets to break geographical service restrictions and expand market coverage for tourism destinations.

2.2 Principles and Technical Advantages of Virtual Reality Technology

Virtual reality refers to an integrated digital simulation technology combining computer graphics algorithm, human-machine interactive design, multimedia simulation and sensor hardware systems. The technology constructs three-dimensional virtual simulation environments via programmed modeling, enabling multi-dimensional interactive perception between end users and digital scenarios with matched hardware facilities. High-precision virtual scene reconstruction relies on real-world scenic data collection and customized algorithm modeling, allowing users to obtain multi-sensory immersive feedback similar to physical onsite tourism experiences.

Unique technical properties enable virtual reality tools to perfectly match smart tourism developmental demands. High-fidelity scene simulation supports digital archiving and virtual exhibition of intangible cultural heritage and geographically remote scenic resources. Immersive human-machine interaction improves user engagement and situational substitution within virtual tourism scenarios, solving low interactivity defects embedded within traditional web-based tourism display modes. Strong technical compatibility allows virtual reality systems to adapt to diverse tourism scenarios including destination promotion, cultural exhibition and tourism education, delivering outstanding industrial scalability and practical applicability.

3. Current Situation and Problems of Virtual Reality Technology Application in Smart Tourism

3.1 Mainstream Application Scenarios of Virtual Reality Technology in Smart Tourism

Virtual reality technology has achieved extensive penetration across segmented smart tourism business scenarios. Virtual destination branding stands as the most mature industrial application. Numerous tourism destinations build full-view digital scenic environments based on virtual reality algorithms. Prospective travelers can browse scenic landscapes, verify supporting service facilities and acknowledge local cultural features via portable or fixed virtual devices before physical travel. Pre-travel immersive digital experiences assist users in travel decision-making and improve conversion efficiency of destination promotional campaigns.

Digital heritage tourism represents another vital application direction. Cultural museums and intangible heritage protection institutions adopt virtual reality tools to reconstruct damaged heritage landscapes and build cloud-based virtual exhibition halls. Cultural resources facing preservation challenges and limited offline exhibition space can obtain sustainable digital inheritance channels. Virtual exhibition systems break spatial and capacity constraints of physical museum venues, granting broader public access to precious cultural tourism resources.

Immersive experiential tourism products have emerged as popular updated business forms in modern cultural tourism industries. A large number of commercial scenic areas and cultural theme parks launch customized virtual reality experience projects. Combined with localized scenario storytelling, such technology creates themed experiential content, enriching diversified offline tourism service portfolios.

Innovative immersive service modes cater to personalized experiential consumption preferences among young traveler groups, promoting service upgrading for traditional scenic destinations.

3.2 Existing Problems of Virtual Reality Technology Implementation in Smart Tourism

Multiple industrial bottlenecks hinder large-scale penetration and high-quality iteration of virtual reality technology within smart tourism ecosystems. Deployment and maintenance costs remain relatively high across industrial markets. Complete virtual scenic reconstruction demands professional hardware equipment, customized algorithm development and continuous post-operation maintenance. Small-scale tourism operators and grassroots scenic destinations lack sufficient capital reserves for digital renovation. Disparities in economic capacity among tourism market participants lead to unbalanced regional deployment of virtual reality tourism projects, generating obvious digital development gaps across different tourism regions.

Insufficient scenario refinement and severe product homogenization restrict experiential quality improvement of virtual tourism products. Most existing virtual reality tourism projects focus merely on landscape simulation, ignoring localized storytelling and cultural connotation embedding. Virtual tourism products from different scenic destinations lack differentiated competitive features. Repetitive and single experiential content reduces user stickiness and secondary consumption willingness. Low-budget virtual simulation projects usually deliver low scene restoration precision and weak immersive perception, failing to satisfy high-standard experiential demands of modern tourism consumers.

Immature industrial operational and managerial frameworks impede sustainable development of virtual reality tourism projects. Most tourism enterprises prioritize initial scenario construction investment while neglecting subsequent operational iteration, user data mining and content renewal. Stable long-term operational mechanisms have not been universally established across the industry. The market suffers from shortages of interdisciplinary talents proficient in both digital virtual technology and tourism commercial operation, restricting continuous innovation and quality upgrading of virtual tourism products.

4. Optimization Strategies of Virtual Reality Technology Application from the Perspective of Smart Tourism

4.1 Iterative Optimization of Virtual Reality Scene Construction Technology

Sustained technical iteration acts as the core driver for quality improvement of virtual reality tourism services. Professional technical teams should optimize scene modeling algorithms to enhance restoration precision of digital scenic environments. Multi-dimensional data collection technologies can capture micro landscape features and localized cultural elements of physical scenic spots, supporting high-fidelity digital reconstruction of tourism and cultural resources. Optimized algorithm frameworks reduce hardware power consumption and customized development costs, lowering digital transformation thresholds for small and medium-sized tourism institutions.

Scenario construction should integrate diversified creative content rather than relying on single landscape simulation modes. Embedding local folk stories, traditional customs and exclusive cultural symbols into digital scenarios helps build differentiated virtual tourism products. Scenario functional design can be customized for heterogeneous user groups. Simplified browsing functions suit ordinary leisure travelers, while professional cultural interpretation and auxiliary research modules serve academic researchers and cultural enthusiasts, improving overall scenario practical value and user matching degree.

4.2 Improvement of Cultural Tourism Digital Operation System

Standardized industrial operational systems lay solid foundations for long-term sustainable operation of virtual reality smart tourism projects. Tourism operators should establish full-lifecycle management frameworks covering project construction, daily operation and content iteration. Post-operation maintenance and content renewal deserve equal attention with initial digital scenario construction. Mining and analyzing user behavioural data generated from virtual platforms helps capture dynamic consumption preferences, supporting targeted product iteration and functional optimization to sustain market competitiveness.

Systematic optimization of talent cultivation frameworks is essential for industrial upgrading. Industrial associations and higher education institutions can launch specialized training programs to cultivate interdisciplinary talents with digital technical proficiency and tourism operational literacy. Tourism enterprises can build internal vocational training systems to improve comprehensive capabilities of existing operational teams. Cross-industry cooperation between technical research institutes, tourism enterprises and cultural institutions facilitates resource integration, technical complementation and collaborative innovation.

Unified industrial specifications and evaluation criteria are required to standardize market development. Industrial associations can summarize verified operational experience of mature projects and formulate unified technical construction standards and service evaluation systems for virtual reality tourism products. Standardized industrial norms restrain low-quality repetitive construction, guide normative high-quality industrial development and optimize the overall market ecological environment.

5. Conclusion

Digital industrial renovation has become an irreversible evolutionary trend within modern global tourism markets. Virtual reality technology delivers core technical support for intelligent upgrading and innovative development of smart tourism industries. Its inherent immersive simulation and human-machine interactive features assist tourism markets in breaking traditional operational limitations, expanding service coverage, enriching tourist experiential forms and realizing digital preservation and innovative inheritance of precious cultural tourism resources. Current virtual reality deployment in smart tourism has formed mature application ecosystems covering destination promotion, cultural heritage exhibition and immersive tourist experience.

Industrial development is still constrained by high technical deployment costs, homogeneous product design, insufficient scenario refinement and imperfect industrial operational systems. Such inherent deficiencies restrict further market penetration and high-quality iteration of virtual reality tourism projects. Iterative optimization of scenario modeling technology, in-depth integration of localized cultural connotations, improved industrial management frameworks and standardized market supervision can effectively resolve mainstream industrial operational dilemmas.

This research systematically summarizes the practical value and existing operational deficiencies of virtual reality technology in smart tourism scenarios, proposing targeted industrial optimization countermeasures. Research outcomes provide practical guidance for digital transformation of tourism enterprises and standardized construction of intelligent tourism destinations. Limited by research conditions, this study does not conduct quantitative empirical regression analysis on user satisfaction of virtual tourism products. Subsequent research can integrate field investigation and data empirical verification to optimize research conclusions and explore diversified digital application modes for modern smart tourism industrial upgrading.

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