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Research on Digital Development Strategies and Approaches for Liaoning's Red Tourism Brand: A Case Study of Dalian

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Abstract: Digital technology has provided a new impetus for the innovative development of red tourism. Liaoning Province boasts a distinctive "Six Red Sites" brand system with abundant cultural resources, yet faces common challenges at the prefectural level, including insufficient brand recognition, homogenized visitor experiences, and limited appeal to younger demographics. Using Dalian as a case study, this paper explores how virtual reality (VR), augmented reality (AR), and generative artificial intelligence (AIGC) can systematically empower the revitalization and upgrading of red tourism brands, focusing on four key dimensions: virtual IP creation, immersive narrative reconstruction, integrated product development, and smart marketing strategies. The research concludes that the core of technological empowerment lies in transforming red culture from mere historical documentation into contemporary immersive experiences, offering forward-looking yet actionable solutions for high-quality red tourism development in Liaoning and similar regions.

Keywords: Red tourism; Brand building; Generative AI; Immersive experience; Virtual IP

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1. Introduction

Red tourism is undergoing a profound transformation amid the advent of the experience economy era and advancements in digital technology. Evolving from specialized educational initiatives to a pivotal component of cultural-tourism integration, red tourism not only fulfills its educational mission but also faces practical challenges in enhancing market appeal and achieving sustainable development. Currently, tourist demands have shifted from superficial sightseeing to immersive cultural experiences and emotional resonance, imposing innovative requirements on its storytelling approaches, product formats, and communication strategies [1].

Liaoning Province boasts abundant red cultural resources, having established a distinctive "Six Red

Sites" brand system centered around its roles as the birthplace of the Anti-Japanese War, a pivotal site in the Liberation War, a source of inspiration for China's national anthem, a departure point for the Korean War, a foundation for the nation's industrial development, and the cradle of the Lei Feng Spirit. Within this provincial strategic framework, Dalian—a key coastal city—possesses red cultural assets spanning labor movement history, martyr memorials, modern historical sites, and maritime defense education, combining province-wide characteristics with unique features inherent to a coastal city. However, significant gaps exist between current development levels and potential: exhibition displays remain predominantly static with insufficient interactivity and experiential elements; brand identity remains fragmented without a unified symbol that enhances recognizability and emotional resonance; marketing approaches are traditional, offering limited appeal to younger audiences; and integration with local tourism resources remains inadequate, failing to create synergistic development momentum.

Immersive technologies represented by VR/AR offer new solutions to these challenges. VR technology creates enclosed immersive environments, ideal for the detailed recreation of historical settings; AR technology overlays digital content onto physical spaces, enabling interactive narratives that blend reality with virtual elements. In recent years, the rise of generative AI technologies—particularly large language models (LLMs)—has further revolutionized content creation and intelligent interaction in VR/AR experiences [2]. However, current applications of these technologies in red tourism remain fragmented and tool-oriented; basic VR viewing or AR QR code scanning have not yet been elevated to a strategic level for building comprehensive brand ecosystems.

Using Dalian as a case study, this paper examines VR/AR-assisted brand design strategies and development pathways. Through an in-depth analysis of the Dalian example, it aims to provide actionable insights and pathways for the digital transformation of red tourism brands across Liaoning Province, thereby comprehensively enhancing brand value, visitor experience, and market competitiveness.

2. Review of relevant studies

2.1. Branding development and technological empowerment of red tourism

Early research on red tourism primarily focused on its political education attributes and resource conservation and development. As the industry has matured, research emphasis has gradually shifted toward paradigm innovation within the context of the experience economy. For red tourism to achieve sustainable development, it must move beyond conventional, didactic models and embrace visitor participation, immersive experiences, and emotional engagement. Brand building is regarded as a key strategy; a successful red tourism brand can effectively integrate resources, establish a distinctive value proposition, and convey core narratives through systematic experiential design [3]. However, there remains a lack of systematic technical frameworks for translating brand concepts into interactive experiences.

VR/AR technology precisely addresses this demand, bringing three transformative impacts to the cultural tourism sector. In digital archiving, 3D scanning and modeling provide solutions for permanent documentation of immovable cultural heritage; in exhibition and interpretation, VR technology enables replication of vanished historical scenes, while AR enhances narrative dimensions at heritage sites; in experience design, research focuses on leveraging these technologies to create engaging narrative environments. Studies demonstrate that well-designed VR/AR experiences significantly enhance visitors' knowledge acquisition and emotional engagement. Recent advancements include LLM-powered intelligent

dialogue systems equipping virtual guides with real-time Q&A capabilities and personalized commentary, as well as AI-driven video generation models that substantially reduce creative costs for historical scene reconstruction. Meanwhile, the commercialization of global spatial computing devices provides more immersive technological platforms for "virtual-real integration" cultural experiences. However, in the context of red tourism, technological applications require careful balancing between enhancing entertainment value and maintaining the seriousness of historical narratives [4].

2.2. Virtual IP as a medium for emotional brand connection

Virtual IPs (such as virtual idols and virtual ambassadors) have demonstrated significant application value in the cultural tourism sector. Research indicates that virtual idols can create vivid, relatable personas through social media management, live-stream interactions, and brand collaborations, serving as an emotional bridge between brands and young audiences. In cultural tourism contexts, virtual IPs are employed in museum tours, intangible cultural heritage promotion, and scenic area branding initiatives, effectively enhancing visitors' emotional engagement and cultural identification [5]. For instance, several domestic virtual idols have participated in urban cultural tourism campaigns, using their digital avatars to narrate local stories and strengthen brands' youthful appeal [6].

3. Current status and key challenges in Dalian's red tourism development

3.1. Overview of existing brand designs

Dalian's red tourism resources span both the New Democratic Revolution period and the early stages of socialist construction, encompassing various forms such as sites of labor movements, revolutionary residences, memorial halls, martyrs' cemeteries, and national defense education bases [7]. Several thematic tour routes have been developed: the "Origin of the Labor Movement" route centered on the former site of the Chinese Workers' Association in Dalian; the "Spirit of Martyrs" route represented by the Guan Xiangying Memorial Hall; the "Modern Historical Sites" route featuring the Lushun Sino-Soviet Friendship Tower; and the "Maritime Defense" route that integrates island landscapes.

3.2. Core bottlenecks

First, the product experience is characterized by static presentation and significant homogeneity. Current offerings primarily rely on image displays, artifact window displays, and one-way narration by guides, lacking dynamic exhibition projects developed with modern digital technologies; visitor engagement remains largely passive rather than active, and product models across scenic areas are highly similar.

Second, narrative dissemination is characterized by a unidirectional approach. Historical storytelling predominantly adopts linear, grand official perspectives, lacking vivid portrayals of individual destinies and micro-level viewpoints. The primary dissemination channels are traditional media and WeChat public accounts with slow content updates, while new media platforms such as short videos and live streaming are underutilized.

Third, the brand image lacks strong recognizability. Dalian's red tourism sector has not yet established a unified brand IP with high distinctiveness; each attraction operates independently, resulting in a vague and fragmented brand image that fails to create a clear and compelling perception among visitors. The brand lacks personalized and emotionally resonant elements, leading to low brand loyalty and low repeat visit rates.

Fourth, technological applications remain superficial. Although a few scenic areas have introduced QR code guides or VR viewing devices, these remain mere tools for information dissemination rather than being deeply integrated with historical and cultural content, thus failing to deliver truly immersive experiences [8].

Fifth, there is insufficient industrial synergy. Red tourism has not been closely integrated with Dalian's advantageous resources, such as coastal tourism and ecotourism, failing to establish a comprehensive product system combining "red tourism with blue/green tourism," which limits the expansion of tourism consumption and enhances overall benefits.

4. Core design approaches for Dalian's red tourism brand assisted by VR/AR

4.1. Personalization of brand IP and digital activation

Visual symbols are extracted from Dalian's revolutionary heritage: the imagery of "lighthouse" and "cornerstone" is derived from the unwavering beliefs of martyrs, while "gear" and "spark" motifs stem from the history of workers' struggles. Elements characteristic of a coastal city—such as "waves" and "sails" — are integrated into the design, ultimately transformed into visual prototypes for virtual IPs through modern design language. High-precision 3D modeling creates digital assets for these IPs, which are enhanced with motion capture, skeletal binding, and AI voice synthesis to achieve natural, fluid movement and dialogue capabilities. Leveraging AR real-time rendering and spatial positioning, the IPs "appear" within authentic historical settings. Through mobile apps, visitors can witness virtual IPs narrating biographies as young revolutionaries at the Guan Xiangying Memorial Hall or explore hidden historical clues at the former site of the Chinese Workers' Association.

4.2. Reconstructing immersive narratives and contextualized interactive experiences

For indoor venues, VR deep-immersive theaters are developed where visitors assume the role of ordinary participants in historical contexts from a first-person perspective, completing tasks aligned with their era within highly realistic environments. Through controller interaction, spatial audio, and tactile feedback, visitors transition from merely "listening to stories" to "experiencing them firsthand." The integration of LLM-powered AI narrative engines transforms experiences from pre-set routes into dynamically generated journeys, enabling free dialogue between visitors and virtual characters while AI generates personalized tasks and explanations in real time, ensuring each experience is unique. For open-air heritage sites and historic districts, AR-based smart navigation applications leveraging location services (LBS) and image recognition are implemented: upon reaching specific locations, mobile screens trigger historical scene reconstructions, virtual character appearances, and in-depth artifact interpretations—such as scanning old building facades at Lüshun's Taiyanggou area displaying photos and events from different periods, realizing the vision of "buildings that can be read and streets that carry memories." These strategies shift visitors from passive observers to active participants, fostering profound emotional resonance through immersive experiences, thereby transforming red education from mere knowledge dissemination into self-directed comprehension and significantly enhancing immersion, engagement, and memorable moments.

4.3. "Red+" integrated products and digital cultural innovation development

The "Red-Blue Symphony" coastal AR tour route allows visitors to scan designated reefs or lighthouses along the seaside road, triggering AR narratives related to Dalian's maritime defense history and the Communist

Party's naval transport routes—such as recreating scenes of communication officers crossing blockade lines using fishing boats near Yanwo Ridge. Meanwhile, the "Red-Green Integration" forest ecology education route enables visitors to scan ancient trees at ecological sites like Jinshitan, displaying botanical knowledge while recounting their role in providing cover for the Anti-Japanese United Army. In digital cultural innovation, AR technology enhances physical cultural products: IP-themed T-shirts and notebooks become interactive entry points that reveal dynamic virtual content upon scanning. The "Dalian Red Cloud Memorial Hall" platform integrates VR immersive theaters, panoramic tours of historical sites, and artifact models, with virtual guides facilitating simultaneous online visits and interactive quizzes. These initiatives seamlessly blend revolutionary narratives with coastal landscapes, ecological education, and daily experiences, allowing visitors to engage with red culture through leisure activities, shopping, and remote interactions—widening the scope of red tourism while strengthening brand relevance and emotional connection in everyday life.

4.4. "IP + Traffic": Intelligent integrated marketing communication

The virtual IP serves as the core driver in building a content marketing ecosystem. Through serialized short video series, web comics, and other youth-oriented cultural formats, Dalian's revolutionary historical events are integrated into youthful narratives. An independent social media account is operated to showcase the character's daily life in Dalian through "daily vlogs", creating an authentic and multidimensional digital persona. On communication strategy, an omnichannel immersive approach is adopted: AR-powered live tours featuring virtual idols, customized AR filter challenges on social media, and user-generated content initiatives to drive viral sharing. For content production, AI-driven technologies establish an "intelligent content factory" that automatically generates video scripts and social media posts using large language models (LLMs), while AI-powered animation tools rapidly produce historical scene visuals, achieving high-frequency, high-quality output through AI-human collaboration. These measures transform the virtual IP from a technical demonstration into a tangible, interactive, and communicable symbol for Dalian's red tourism brand.

5. Conclusion

Driven by the deep integration of cultural tourism and China's national cultural digitalization strategy, Liaoning's red tourism has evolved beyond being merely a vehicle for patriotic education, entering a strategic phase for brand development. Given the increasingly discerning aesthetic preferences and fragmented information consumption habits of younger travelers, the traditional "historical sites + exhibition panels" model can no longer maintain lasting appeal. Red tourism in Liaoning must shift from resource display to brand building—a transition that not only addresses the challenge of homogenized competition but also leverages technological innovation, emotional resonance, and traffic management strategies to transform red cultural resources into distinctive, compelling modern cultural tourism IPs.

The integration of VR/AR, AIGC, and LLM not only addresses the challenges in red-themed narratives, such as difficulties in scene reconstruction and weak interactivity, but also enables virtual IPs to truly become conversational and empathetic "cultural ambassadors." By creating exclusive digital personas and establishing emotional connections, red history is no longer a cold timeline but a cultural experience that can be perceived, touched, and shared further. Meanwhile, Liaoning should proactively embrace traffic-driven strategies by embedding core IPs like the "Six Red Sites" into the dissemination networks of social platforms

such as TikTok and Xiaohongshu, leveraging algorithmic recommendations to reach younger audiences and achieve a closed loop of "memory–resonance–dissemination–visitation."

More importantly, Liaoning possesses unique advantages in integrating cultural and tourism development: its diverse resources—including industrial heritage, winter sports facilities, coastal landscapes, and Manchu culture—naturally complement red tourism. When combined offerings such as "red + green", "red + industrial", and "red + maritime" precisely cater to tourists' varied preferences, the red tourism brand transcends being merely an isolated exhibition hall; it becomes a flagship initiative that connects the province's cultural and tourism assets and fuels regional economic vitality. Consequently, Liaoning's red tourism has evolved from being confined to individual sites to establishing a distinctive provincial identity, securing an irreplaceable position as both a spiritual landmark and a major attraction hub in the digital era's competitive yet collaborative cultural tourism landscape.

Disclosure statement

The authors declare no conflict of interest.

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