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BRIDGING HERITAGE AND TECHNOLOGY: A REVIEW OF DIGITAL APPROACHES IN HERITAGE TOURISM

Ruslinda Abdullah^{1*}, Nur Dalilah Dahlan², Azrul Hazri Jantan³

¹Department of Design and Architecture, Universiti Putra Malaysia, Malaysia

 gs67832@student.upm.edu.my

 <https://orcid.org/0009-0005-3727-5723>

²Department of Design and Architecture, Universiti Putra Malaysia, Malaysia

 nurdalilah@upm.edu.my

 <https://orcid.org/0000-0002-5324-9091>

³Department of Computer Science and Information Technology, Universiti Putra Malaysia, Malaysia

 azrulhazri@upm.edu.my

 <https://orcid.org/0000-0001-9462-0187>

*Corresponding Author

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Abstract:

This study examines the application of digital technologies in the documentation and promotion of heritage tourism through a systematic literature review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. Articles were collected from major academic databases, including Scopus, ScienceDirect, and Google Scholar, covering publications from 2021 to 2024. The screening process resulted in 35 relevant articles for detailed analysis. The findings reveal increasing adoption of digital technologies, including Augmented Reality (AR), Virtual Reality (VR), Geographic Information Systems (GIS), Heritage Building Information Modelling (HBIM), and digital platforms, in heritage tourism. These technologies enhance visitor engagement, improve heritage documentation, and support more effective tourism promotion. The review also identifies several research gaps, particularly the limited attention given to non-United Nations Educational, Scientific and Cultural Organization (UNESCO) cities and smaller heritage destinations. The study provides insights into emerging technological trends. It highlights practical strategies for integrating digital technologies into heritage conservation and tourism development.

Keyword:

Conservation Strategies, Digital Technology, Heritage Tourism, Systematic Review



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Introduction

Heritage tourism represents an important segment of the global tourism industry, contributing significantly to cultural preservation and economic development. Within this sector, architectural heritage has become a major attraction for visitors seeking to explore the historical, cultural, and aesthetic values embedded in historic buildings. Countries such as Italy, Spain, and China have long recognised the importance of heritage architecture as a key driver of their tourism sectors (Castillo-Manzano et al., 2021; Lin et al., 2024; Wang et al., 2024). However, effectively documenting and promoting these assets remains a challenge. With the rise of digital technologies such as AR, VR, Three-Dimensional (3D) mapping, and online platforms, new opportunities have emerged to enhance the heritage tourism experience. For example, Japan and South Korea have leveraged AR to display images of historic buildings in their original form, attracting more tourists. In addition, platforms such as “Google Arts & Culture” allow virtual exploration of heritage sites, making heritage tourism more accessible to the global community (Verde & Valero, 2021).

However, in many developing countries, particularly in Southeast Asia, the application of digital technology in heritage tourism remains limited, often relying on traditional documentation methods such as photography, drawings, and written reports. These methods often struggle to capture the uniqueness and subtlety of the actual design. In addition, the promotion strategy for architectural heritage relies heavily on conventional brochures and signage, which are less appealing to younger generations, who are more inclined to use digital and interactive content. Technologies such as 3D laser scanning, digital photogrammetry, and Building Information Modelling (BIM) offer significant advantages in documenting heritage architecture with greater accuracy and detail (Çakici & Kaçdi, 2023). As awareness of the benefits of these technologies grows, digital documentation methods are expected to replace traditional methods for preserving cultural heritage.

Furthermore, the preservation and promotion of heritage architecture are often concentrated in cities recognised by UNESCO. Other cities with a similar level of historical significance did not receive the attention they deserved. The absence of comprehensive digital documentation contributes to the lack of awareness of the historical value of these cities (Noor Hishamuddin et al., 2024). Most Southeast Asian countries with conservation and preservation strategies for historic sites have shown promise in promoting cultural heritage, provided they can overcome challenges and ensure sustainable integration for long-term success (Rajendran & Rashid, 2024).

Another major challenge in implementing digital technologies in heritage tourism is the lack of collaboration and efforts among stakeholders, including governments, heritage institutions, and the tourism industry. These efforts are often hampered by a lack of funding, technological expertise, and comprehensive implementation strategies (Amir et al., 2020; Shanmugam et al.,

2024). These problems can be overcome using integrated approaches such as increasing digital readiness, involving communities in heritage preservation initiatives, and adopting a multidisciplinary approach. This ensures the effectiveness of digitalisation strategies in the heritage tourism sector.

Despite the growing adoption of digital technologies in heritage tourism, existing studies remain fragmented across disciplines such as architecture, tourism, and digital heritage studies. A comprehensive synthesis focusing specifically on digital technologies for documenting and promoting architectural heritage tourism remains limited.

Study Rationale

This study is crucial in connecting heritage tourism and digital technology, two rapidly evolving fields in this modern era. Previous studies have shown that heritage tourism has been appealing to the younger generation because it offers unique cultural and educational experiences and raises awareness of environmental and historical preservation (Kastenholz & Gronau, 2022). In addition to attracting young tourists, the tourism sector needs to adopt digital technologies that offer immersive, interactive experiences rather than conventional promotional tools such as brochures and static signage to engage its digital-savvy audience (Maietti, 2023). These experiences allow visitors to explore heritage buildings virtually through VR, thus enriching their understanding of cultural and architectural identity. They can also be educated through AR, which allows users to revisit the original forms of historical structures, making the visit more meaningful and in-depth (Gatelier et al., 2022). Zhang (2023) also highlights the need for innovative, collaborative, and sustainable approaches to reconcile the tensions between tourism utilisation and heritage conservation (Zhao et al., 2023). The results of this study can help stakeholders understand how technology can be leveraged to overcome challenges such as declining tourist interest and inadequate heritage documentation.

Methodology

SLR Approach

The study employed a Systematic Literature Review (SLR) method to assess digitalisation in heritage tourism, identify research gaps, and propose new research directions. Through SLR, the process of searching, screening, and analysing related articles was carried out systematically to ensure the accuracy and reliability of the study results (Mendoza et al., 2023). This study employed the PRISMA framework as the primary guideline for systematic selection and analysis of relevant literature to the research topic (Buragohain et al., 2024). It will ensure that the process of searching and filtering articles is performed transparently and in an orderly manner, thereby increasing the reliability and accuracy of the research results.

Through PRISMA, this study documented each step in detail, including the identification, screening, qualification, and article selection phases (Brooks et al., 2023; Nikolarakis & Koutsabasis, 2024; Iakovaki et al., 2023). The PRISMA approach was applied to ensure a systematic and transparent selection process. Initially, a total of 2815 articles were identified from Scopus, ScienceDirect, and Google Scholar databases. After removing duplicates and applying the inclusion and exclusion criteria, 246 articles were screened. Finally, 35 articles were selected for detailed analysis. This ensured that only high-quality articles relevant to the research topic were included for analysis.

The first step in using PRISMA is to set a clear and specific Research Question (RQ). To retrieve the RQs, this study employs the PICO framework, which comprises four parts: the problem or target population, the interventions used to address it, the comparison elements of the study, and the outcomes (Salazar-Sepúlveda et al., 2022). As a result, the PICO tool presented in Table 1 is a helpful, structured approach to formatting intervention questions. It should be used as a starting point.

Table 1: PICO Table

P	I	C	O
Population/Problem	Intervention	Comparison	Outcome
What is the condition you are interested in?	What do you want to do with this problem?	What are the alternatives to the intervention?	What are the relevant outcomes?
Architectural heritage sites in urban and rural areas.	The use of digital technologies such as AR, VR, GIS, HBIM and digital platforms.	Traditional approach (without digital technology) vs. digital technology in documentation and promotion.	Overall outcomes
Challenges: Incomplete documentation, ineffective promotion and digital technology gaps.	Purpose: Documentation of heritage sites, tourism promotion and interactive experiences.	Comparison between heritage sites in the application of technology.	Improving visitor experience through digital interaction and impact on tourism. Deep understanding of historical and architectural values. Reducing the digital technology gap at heritage sites.

Source: (Author)

This framework is a flexible research tool that can be used across various research fields, depending on the context of the problem or issue at hand. This method was chosen because it effectively structures the questions used to select publications for this study, making the selection process and the search results more precise and accurate. By setting a focused question, the researcher can ensure the study includes only articles relevant to the scope of heritage tourism and digital technology. The main RQs derived from the framework explore the use of digital technology in architectural heritage tourism, identify current gaps, highlight emerging digital trends, and seek the most effective approaches to documentation and promotion. The goal is to ensure heritage architecture remains relevant, appreciated, and engaging for future generations through innovative digital integration.

Search Protocol

A study protocol is a crucial document that outlines the systematic procedures for each step in a systematic review study (Nikolarakis & Koutsabasis, 2024). This study outlines the search strategy, inclusion and exclusion criteria, and data analysis methods. Note that the search strategy is a key step in gathering relevant articles. This study utilised databases such as Scopus,

ScienceDirect, and Google Scholar, as they provide access to high-quality journal articles indexed in technology and tourism. Subsequently, these keywords were combined using Boolean operators, such as “AND,” to narrow the search results to articles that included digital technology and heritage tourism elements. The “OR” operator groups keywords, synonyms, alternative spellings, and acronyms. This strategy is justified to ensure that only genuinely relevant articles are included in the analysis. This approach also helps identify articles highlighting trends and innovations in heritage tourism. Table 2 presents the definitive search string employed by SLR for the articles’ resources.

Table 2: Search String for The Database

Journal	Search String
Scopus & ScienceDirect	(“Digital technology” OR “Digitalisation”) AND (“architectural heritage” OR “Cultural heritage”) AND (“heritage tourism” OR “tourism”)
Google Scholar	allintitle: heritage tourism “digital technology” OR digitalisation

Source: (Author)

Data Collection

The review primarily focused on the existing literature published between 2021 and 2024. Two major academic databases, Scopus and ScienceDirect, were chosen. Google Scholar was added as a secondary database to identify additional research resources, as it is easily accessible worldwide. A total of 2815 papers were obtained using the keywords string. Refer to Figure 1 for the collection and inclusion of the articles.

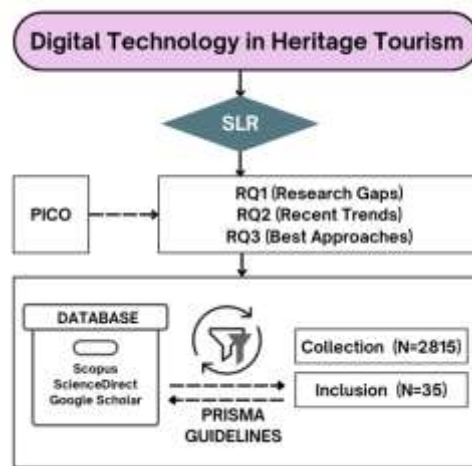


Figure 1: Resources of Articles

Inclusion and Exclusion Criteria

Inclusion and exclusion criteria were established to filter the search results and ensure that the data collected in this study are high-quality and relevant to the research objectives. The list of the criteria is shown in Table 3.

Table 3: Criteria of Inclusion and Exclusion

Factor	Inclusion Criteria	Exclusion Criteria
Purpose	Including studies that discuss the use of digital technologies (AR/VR, GIS, HBIM, digital platforms) in the documentation and promotion of heritage architectural tourism.	Does not include studies that only discuss tourism or technology in general without any connection to heritage architecture.
Sample	Articles involving case studies related to architectural heritage sites or heritage tourism from around the world including non-UNESCO cities.	Excludes articles that do not focus on heritage architecture or tourism, or that only refer to intangible heritage.
Data Collection	Research studies that use authentic primary or secondary data such as interviews, case studies, experiments, or previous literature reviews.	Articles that do not explicitly state the data collection method or are based only on theoretical speculation without empirical evidence.
Data Analysis	Studies that use clearly explained qualitative, quantitative, or mixed-methods analysis.	Studies that do not state the analytical method or are purely narrative in nature without clear analysis.
Format	Article published in Scopus, ScienceDirect and Google Scholar and available in full access and written in English only. Sources published within the year 2021-2024.	Non-academic journal articles, unofficial reports, blogs, and articles that are not fully accessible or not in English. Studies published before 2021.

Source: (Author)

The second stage was screening, during which the abstracts of each article were reviewed to determine whether each article met the specified inclusion and exclusion criteria. The qualification stage involved thoroughly assessing the title and abstract and reading the entire article to ensure the content was genuinely relevant to the study's scope. After reviewing the full texts of the papers, any papers without a connection to the investigation at this level were eliminated. Finally, in the inclusion stage, only articles that met all criteria were included in the study analysis. The screening thus identified 35 articles that met our inclusion criteria, and the process is shown in Figure 2. By setting these criteria, researchers can ensure that this study is based on authentic, up-to-date sources and that it contributes to an in-depth understanding of the integration of digital technology into architectural heritage tourism.

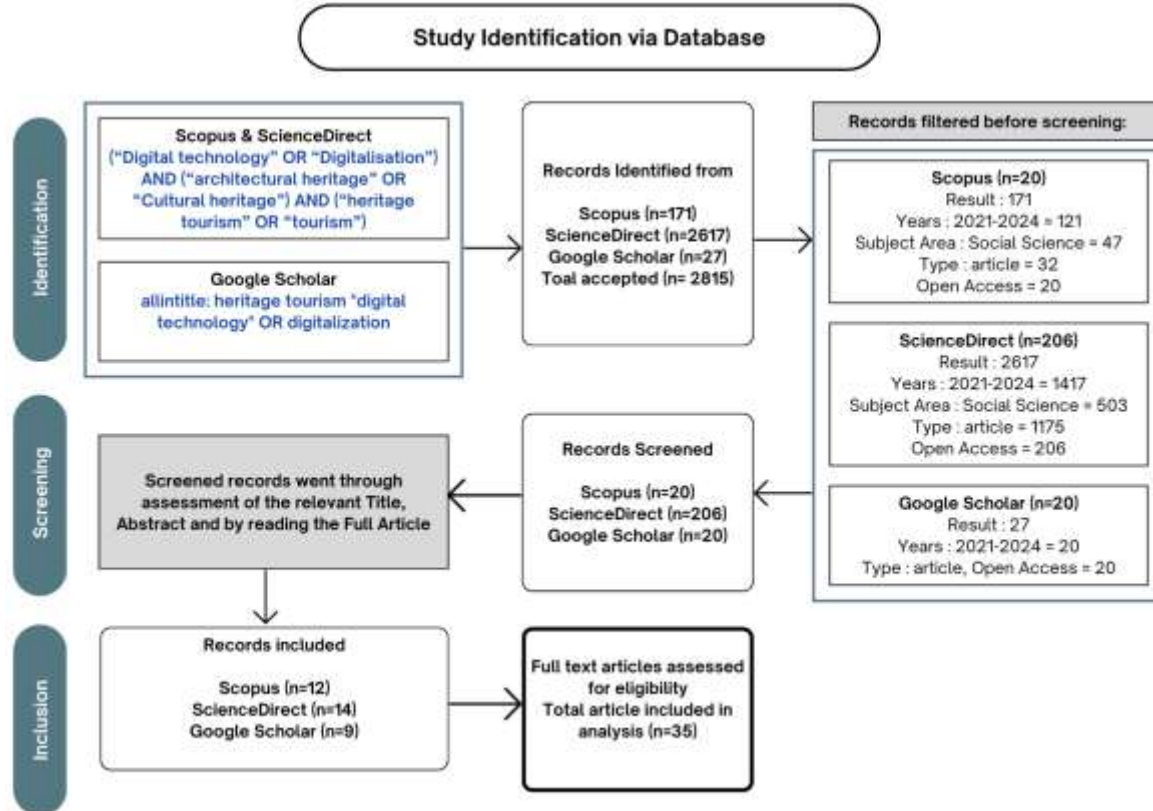


Figure 2: PRISMA Flow Diagram of the Article Selection Process

Data Extraction

The data extraction process involved systematically organising key information from each selected article into a structured table, including the author, publication year, article title, research aim, methodology, key findings, and journal source. This table included the author, year, article title, aim, methodology, key findings, and journal type. This step was intended to facilitate analysis and comparison between articles.

The study selected various articles that show interesting developments in the digitalisation of heritage tourism. AR has become one of the main tools for enriching the tourist experience (Nikolarakis & Koutsabasis, 2024). Through AR, tourists can interact with digital elements that overlay physical reality, making history and architecture more interesting and understandable. In addition, Buragohain et al. (2024) highlight the significant potential of the metaverse to create immersive virtual experiences, enabling tourists to “visit” heritage sites without being physically present. This technology facilitates access and provides solutions for heritage sites that are difficult to reach or sensitive to damage.

Nonetheless, despite these positive developments, significant knowledge gaps still exist. A study highlights that most documentation and promotional efforts remain focused on UNESCO World Heritage Sites, leaving small towns with unique architectural value often neglected (Fadli et al., 2022). In addition, Mendoza et al. (2023) note the lack of clear global guidelines for the use of digital technologies for documentation and promotion. This lack of standardisation leads to variations in the quality of technological applications, with some projects delivering impressive results while others only meet minimal requirements.

Furthermore, Buragohain et al. (2024) raise questions about the challenges of authentication in the metaverse, where digital elements may not fully reflect the historical value of heritage sites. Various strategies have been proposed in the reviewed articles to address these challenges. One of the main strategies is the development of integrated applications that combine AR, VR, and 3D mapping to provide a seamless user experience. This strategy enriches the tourist experience and provides a comprehensive platform for digital documentation. In addition, Fadli et al. (2022) suggested that the greater focus should be placed on small towns and heritage sites that UNESCO does not recognise, to ensure they also receive appropriate attention and conservation. Mendoza et al. (2023) also emphasised the need to establish global standards for digital technology to ensure consistent and reliable results.

As shown in Tables 4 and 5, these articles were divided into two approaches. Table 4 focused primarily on digital integration, whereas Table 5 used contemporary methods. This section summarises the key findings and their relation to the digital exploration in the context of heritage tourism. The study shows that 30% of the reviewed articles utilised advanced digital technologies, including AR, VR, HBIM, GIS, and other 3D applications, while another 20% employed digital platforms, such as social media and websites. Nevertheless, 37% are still using contemporary methods, such as case studies, surveys, and interviews.

Table 4: Research Design Adopted Approaches That Utilise Digital Technologies.

Author	Design/Methods											Key Findings	
	AR	VR	HBIM	GIS	3D Laser Scanning (LiDAR/Drone)	Digital Survey	3D applications	Digital Platform (Social Media/Web)	Case Studies	Fieldwork	Survey		Document Analysis
Rivero et al. (2024)	+				+								AR technology enhances accessibility and public engagement.
Zhenrao et al. (2021)		+			+		+						Digital integration promotes sustainable cultural tourism and effective management.
Maietti (2023)						+	+						Framework fosters inclusion and sustainability for neglected heritage sites.
Aburamadan et al. (2022)			+						+				HBIM enables detailed documentation and cross-sector collaboration.
Ghosh et al. (2024)					+	+	+						Digital tools provide unparalleled precision in cave art conservation and engagement.
Sangmanee & Suwanwerakamtorn (2023)		+		+			+						WebGIS enhances cultural tourism experiences with efficient tools for local authorities.
Zollo et al. (2022)								+					Social media and digital experiences enhance museum loyalty and economic support.
Sewasew et al. (2024)			+				+						3D city models improve visualization and conservation in resource-limited contexts.
Bernini & Galli (2023)							+	+					Collaborations and spatial interactions boost museum appeal.

VR and AR technologies can enhance tourist engagement by offering immersive and educational experiences that increase awareness of historical sites. GIS and HBIM contribute to more strategic and detailed heritage documentation. Meanwhile, digital platforms such as mobile applications and websites facilitate access to heritage information and expand promotional reach. This initial framework serves as a basis for developing a holistic model in future empirical studies. It combines theoretical and practical perspectives to support the strategic and sustainable use of digital technologies in the preservation and promotion of heritage architecture.

Study Description

The studies included in the final sample were distributed across 35 articles from three different sets of academic journals and database sources, including Scopus, ScienceDirect, and Google Scholar. Note that, instead of focusing on identifying research gaps, current trends, and best practices, these articles also sought to understand the latest trends, year-by-year distributions by study location, and the leading technology domains used, which contributed to the study's objectives.

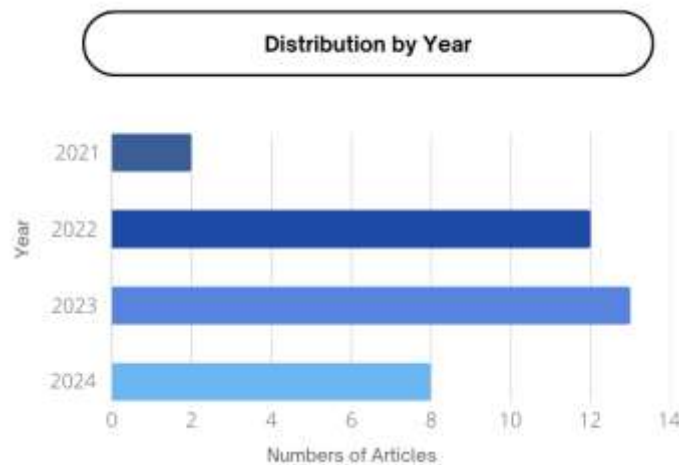


Figure 4: Publication Trend by Year

Figure 4 summarises the publication dates from 2021 to 2024. The distribution of articles indicates that studies on digital technologies in heritage tourism have increased significantly in recent decades, particularly after 2020. Twenty-two articles were published between 2021 and 2024, indicating a significant increase following the COVID-19 pandemic. This situation demonstrates the urgent need to digitise heritage sites and adapt new technologies to attract tourists during the global economic recovery. Articles by Gonçalves et al. (2022) and Wen et al. (2023) describe the development of technologies, such as AR and VR, used to attract tourists to cultural heritage sites. This trend suggests a growing interest in this topic, particularly over the last five years. Consequently, the results show that this study reached its peak in 2022 and 2023. Articles such as Sangmanee and Suwanwerakamtorn (2023) emphasise the need to develop a more integrated digital tourism system, while Sukardi et al. (2022) focus on digitalising cultural heritage from a legal perspective. This increase in publications exhibits that this issue is gaining global attention due to technological developments and the increasing demand for heritage tourism.

Geographically, these articles cover global studies with a focus on Europe and Asia. Studies from Europe dominate, with 13 articles, including Italy, Spain, Portugal, and Norway. This can be attributed to the region’s strong heritage conservation efforts, which incorporate technologies such as GIS, 3D modelling, and VR. Study Researchers’ focus not only on urban areas; those by Ghosh et al. (2024) examined the application of technologies such as photogrammetry and laser scanning to preserve heritage architecture in rural areas as well. Meanwhile, Asia contributes 11 articles, focusing on China, India, and Indonesia. Studies from Asia focus on the conservation and promotion of physical heritage using technologies such as HBIM and AR/VR. Several studies from the Middle East, such as those from Jordan and Eritrea, for example, focus more on architectural heritage conservation using the HBIM approach. Studies from these locations focus on developing digital models that support heritage documentation efforts for long-term conservation. For example, Wen et al. (2023) used the Unified Theory of Acceptance and Use of Technology (UTAUT) to examine users’ acceptance of digital technology in China, while Sangmanee and Suwanwerakamtorn (2023) examined the use of GIS technology in Thailand. The ring chart (Figure 5) shows that most studies focused on urban areas rather than rural areas.

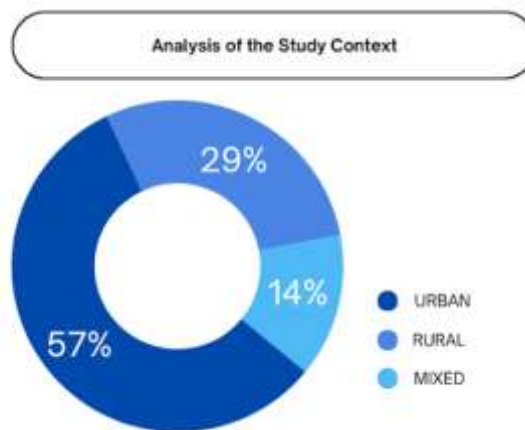


Figure 5: Distribution and Context of the Research

Key Technology Domains

The descriptive analysis identified five key technology themes in the articles analysed. Refer to Table 6 below for the data findings.

Table 6: Key Technology Domain

Key Technology	Articles	Purposes
Augmented Reality (AR) and Virtual Reality (VR)	10	Enrich the tourism experience with interactive digital storytelling.
Geographic Information System (GIS) and 3D Modeling	8	Physical heritage conservation and geospatial data management.
Digital Platforms and Social Media	6	Promotion and communication of heritage through websites and social media.

Heritage Building Information Modeling (HBIM)	4	Digitise heritage architecture.
Internet of Things (IoT) and Smart Systems	3	Transforming heritage cities into smart cities through digital management systems.

Source: (Author)

In terms of the main domains, these articles show that digital technologies have been used for the documentation, preservation, and promotion of cultural heritage. Sukardi et al. (2022) emphasise the importance of digitalisation from a legal perspective, while Gonçalves et al. (2022) discuss how digital approaches can promote cultural routes. In addition, a study by Ghosh et al. (2024) proves that photogrammetry can produce accurate 3D models for conservation purposes. These findings demonstrate the ability of digital technologies to increase tourism attractiveness and ensure the sustainability of cultural heritage.

The study's results show that the latest trends in the use of digital technologies for documenting and promoting heritage architecture are rapidly growing, especially in the context of tourism. Various studies have focused on AR, VR, GIS, and interactive digital platforms. Each of these technologies offers a unique approach to overcoming traditional challenges in preserving, promoting, and presenting cultural heritage to a global audience.

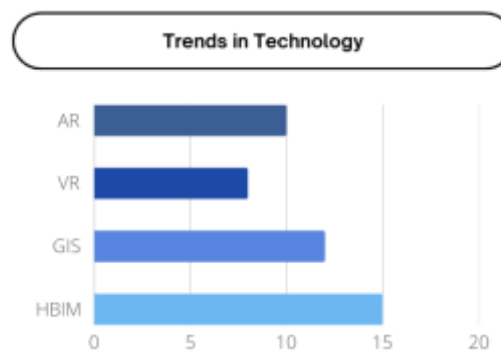


Figure 6: Current Technological Applications

The use of AR and VR has received significant attention in recent studies (Figure 6). An article by Wen et al. (2023) highlights the important role of AR and VR in enhancing the heritage tourism experience by providing interactive virtual simulations of historical locations. This technology enables visitors to explore areas that are otherwise difficult to access, thereby conveying a more comprehensive historical narrative. Other studies, such as those conducted by Gonçalves et al. (2022), demonstrate how virtual cultural routes using VR can connect tourists to heritage locations without requiring physical presence, making this technology particularly relevant during the global pandemic. In addition, GIS has become a highly effective tool for heritage tourism. Sangmanee and Suwanwerakamtorn (2023) have developed a WebGIS framework that can integrate interactive maps with cultural heritage location information. This technology enables tourists to access comprehensive information about heritage sites, including their history, architecture, and cultural significance. GIS is also used to analyse and monitor changes in historic areas, helping site managers make better conservation decisions. However, digital platforms, including mobile applications and interactive websites, are gaining increasing attention. A study by Sukardi et al. (2022) highlights how digital platforms can document cultural heritage in more detail, including legal

aspects and data management. Nonetheless, this approach can be applied to certain areas that are still using the traditional methods and planning to go further in bridging heritage and technology.

Research Gaps

This study highlights significant gaps in the exploration of digital technology for architectural heritage documentation and promotion (Figure 7). Despite the growing application of digital technologies in heritage tourism, existing studies remain fragmented across different disciplines such as architecture, tourism, and digital heritage studies. Therefore, a systematic synthesis of the digital technologies used to document and promote architectural heritage tourism is necessary to consolidate existing knowledge and guide future research. A comprehensive synthesis that specifically examines digital technologies for documenting and promoting architectural heritage tourism remains limited.

Primary among research gaps are resource limitations, especially in funding, expertise, and technological infrastructure, which hinder consistent implementation. Rural accessibility remains a challenge, as many heritage-rich yet remote areas lack digital connectivity and technical support to adopt modern tools. Moreover, fragmented systems across institutions and agencies lead to inconsistent documentation of data and poor coordination. These gaps lead to underexplored impacts, limited outreach, and inadequate digital preservation, jeopardising the lasting visibility and significance of heritage buildings in both urban and rural settings.

Another main gap that emerged was the lack of attention to non-UNESCO cities. Most existing studies focus on UNESCO-recognised heritage sites, such as World Heritage cities, as this status usually attracts greater attention to tourism, preservation, and technology investment (Arumugam et al., 2023; Kutlu et al., 2024). However, studies of non-UNESCO cities or other small towns remain limited.

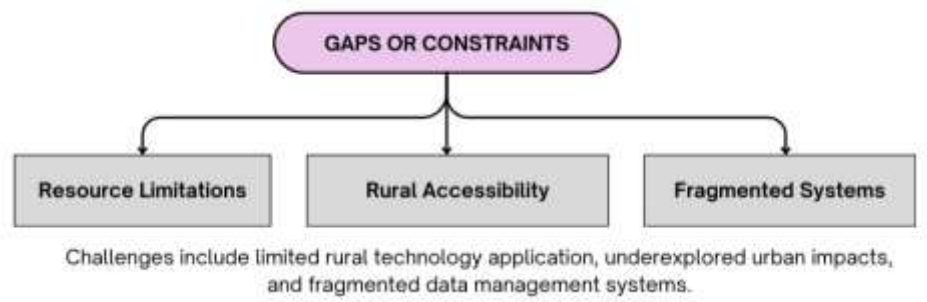


Figure 7: Gaps in the Study

This lack has resulted in an imbalance in heritage tourism strategies. Articles from Wen et al. (2023) and Gonçalves et al. (2022) focus more on large cities or famous sites that have received global recognition. These studies often focus on integrating advanced technologies, such as VR and GIS, to enhance established heritage sites. While these technologies are beneficial, a gap arises when little attention is paid to the potential of small cities to leverage digital technologies for similar purposes. These cities often lack sufficient funding, human resources, and technological infrastructure to implement digital initiatives. A study by Sukardi et al. (2022) highlights the significance of digital platforms in heritage documentation. Nevertheless, their implementation is often more appropriate for locations with strong institutional support. On the other hand, those cities require a more flexible, cost-effective approach that is rarely explored in the literature. This research gap underscores the need to expand the scope of

research to encompass non-UNESCO cities within the framework of digital heritage promotion and documentation. By paying attention to these small towns' challenges, opportunities, potential, and context, future research can help promote equity in heritage preservation and enrich the tourism experience.

Best Approaches

The study results demonstrate that several digital techniques and strategies have proven effective in documenting and promoting architectural heritage, making them the most effective approach to heritage tourism.

Table 7: Best Approach in the Context of Heritage Tourism

Digital Tools	Study	Context
Virtual Reality (VR)	Wen et al. (2023) and Ghosh et al. (2024) create realistic simulations of difficult-to-access locations, such as cave paintings or fragile historical buildings. The virtual cultural trail explored by Gonçalves et al. (2022) allows tourists to “visit” heritage sites virtually, an innovation very useful during the COVID-19 pandemic when physical travel has become limited.	Provides visitors with the opportunity to explore remote or difficult-to-access locations and also helps convey historical narratives in depth.
Augmented Reality (AR)	Sangmanee and Suwanwerakamtorn (2023) show how AR can be used to deliver additional information about heritage architecture through mobile applications. Nikolarakis and Koutsabasis (2024) used AR for interactive historical storytelling at heritage sites.	Adds value to visitors by providing historical, architectural, and cultural narrative in real-time while they are at the heritage site.
Geographic Information Systems (GIS)	Van Lanen et al. (2022) and Sangmanee and Suwanwerakamtorn (2023) show the effectiveness of WebGIS in developing a comprehensive digital database for heritage tourism.	mapping of heritage sites, producing accurate data analysis for conservation purposes, and sustainable tourism planning.
3D Modeling and Heritage Building Information Modeling (HBIM)	Penjor et al. (2024) and Aburamadan et al. (2022) highlight how HBIM is used to digitize the structure of historic buildings, enabling long-term conservation and systematic data management.	Effective in documenting architectural heritage accurately and comprehensively.

	3D modeling was used by Sewasew et al. (2024) to develop a complete historic city model with spatial elements and architectural structures.	
Photogrammetry and Laser Scanning	Ghosh et al. (2024) offer a sophisticated approach to documenting architectural heritage.	Produces highly accurate 3D models, enabling detailed visual records for digital conservation and promotion. These models can be used in virtual exhibitions or educational applications to enhance understanding of cultural heritage.
Digital Platforms and Social Media	Gawel's (2023) study shows how museums in Poland leveraged social media during the COVID-19 pandemic to maintain visitor engagement.	Digital platforms such as websites, mobile applications, and social media have proven effective in promoting heritage sites to a wider audience.

Source: (Author)

Technologies such as VR, AR, GIS, photogrammetry, and interactive digital platforms have significantly impacted tourists' understanding, accessibility, and perception of heritage sites. These methods can be grouped into four clusters that align with the purposes and context of digital integration (refer to Figure 8).

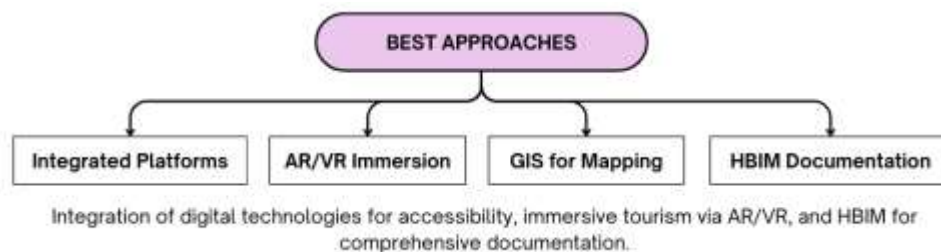


Figure 8: Effective Strategies of Techniques Highlighted in the Articles

Discussion

The first finding suggests that AR and VR technologies are emerging as dominant trends in architectural heritage tourism. Studies by Chatzigrigoriou et al. (2021) and Wen et al. (2023) demonstrate how AR and VR create immersive, interactive virtual experiences for visitors. This approach enables visitors to interact more actively with cultural heritage elements through immersive digital environments. For example, historical sites or old buildings that are difficult to visit can be accessed through virtual simulations, thereby opening their history to more tourists. In the context of promotion, this technology has attracted the younger generation, which is more inclined to adopt a technology-based approach. This aligns with the study's objective to identify the latest trends in the use of digital technology to enrich the heritage tourism experience.

In addition to AR and VR, GIS technology and 3D modelling have also been identified as important components in preserving architectural heritage. Studies by Van Lanen et al. (2022) and Sewasew et al. (2024) demonstrate the use of GIS for spatial mapping and analysis of historical landscapes, while 3D modelling facilitates the documentation of architecture with greater accuracy and detail. GIS's ability to map geospatial data allows for more systematic management of heritage sites. At the same time, 3D modelling supports long-term conservation efforts. These results prove that this technology is not only limited to promotion but also plays an important role in ensuring the sustainability of physical heritage for future generations.

However, the study's results also reveal gaps in this field, especially in non-UNESCO cities and small sites that are often overlooked. Most existing studies focus on globally recognised heritage sites, such as the Grand Canal in China, or large European museums. For example, the study by Ghosh et al. (2024) focuses more on famous locations, while small towns with significant historical value are still understudied. By leveraging technologies such as AR, VR, and digital platforms, these cities can be promoted more widely, thus contributing to local economic development.

The best approaches identified in this study also support the identification of the most effective strategies for documenting and promoting architectural heritage. Technologies such as HBIM, discussed by Aburamadan et al. (2022) and Penjor et al. (2024), have proven their effectiveness in digitising historic architectural structures. HBIM enables the systematic recording of heritage buildings through digital models incorporating both technical and visual data. This approach is fundamental in ensuring conservation efforts can be carried out efficiently. In the context of promotion, utilising digital platforms and social media, as discussed by Gawel (2023), has proven effective in increasing global access to heritage information at a low cost. These findings demonstrate that digital technologies not only enhance visitor engagement but also provide strategic tools for improving heritage documentation, conservation planning, and destination promotion.

Conclusion and implications

Main Conclusions

This study provides a comprehensive overview of the use of digital technology in the preservation, documentation, and promotion of heritage architecture tourism. A systematic analysis of 35 articles identified several key trends in technological developments, including the use of VR, AR, 3D modelling, HBIM, GIS, and digital platforms. These technologies play a role in digitising heritage sites for preservation and have the potential to enrich the tourism experience through interactive, immersive approaches. Nonetheless, the analysis results also show significant gaps, especially in small towns and non-UNESCO locations, which are often overlooked in existing research. The implications of this study are significant in ensuring that the field of heritage architecture tourism continues to grow sustainably in the digital era. Integrating digital technology opens new opportunities for various stakeholders, including tourism industry practitioners, policymakers, and local communities (Ali et al., 2024). Using technologies such as VR/AR and digital platforms can attract the younger generation's interest, strengthen global heritage promotion, and facilitate access to difficult-to-visit heritage locations. Meanwhile, 3D modelling and HBIM provide systematic and detailed data, supporting long-term conservation efforts to ensure the sustainability of heritage sites. In addition, digital platforms and social media can be leveraged to promote the city to a global

audience at a lower cost. This technology enables the digitisation of old buildings and important locations in an interactive format, thereby conveying historical narratives more effectively. Overall, this systematic review provides a consolidated understanding of how digital technologies are transforming the documentation and promotion of architectural heritage tourism. By identifying current trends, research gaps, and best practices, this study offers valuable insights for researchers, policymakers, and tourism practitioners seeking to develop more sustainable and inclusive heritage tourism strategies.

Implications

This study contributes to the theoretical understanding of digital technology integration in architectural heritage tourism by synthesising multidisciplinary literature across tourism, architecture, and digital heritage studies. From a practical perspective, the findings guide heritage managers, tourism practitioners, and policymakers in adopting effective digital strategies to enhance heritage tourism promotion. For tourism practitioners, AR and VR can enrich the visitor experiences by enabling exploration of heritage sites in their original form, even if the physical structures have been damaged. This technology also makes less popular destinations in small towns more attractive. Digital platforms and social media, on the other hand, allow for more effective promotion with low cost and global reach. For policymakers, this study emphasises the need to formulate policies supporting digital technologies in heritage conservation, especially for non-UNESCO towns. Policies should include digital infrastructure, internet access, human resource training, and financial incentives to encourage industry and local communities to adopt this technology. Furthermore, for researchers, this study opens the door to further research, especially on lesser-known sites. Research can focus on the effectiveness of digital technologies in terms of cultural sustainability, local economic impact, and access to technology in developing countries.

Limitations

This study provides a comprehensive analysis of the use of digital technologies in the documentation and promotion of heritage architectural tourism. Nevertheless, several limitations affect the generalisability and accuracy of this study's findings. Firstly, the inclusion of only English-language articles may introduce language bias and exclude important studies in other languages, such as Spanish, French, or Mandarin. This limits the global perspective, especially from non-English-speaking countries that are active in heritage conservation. Secondly, limiting the selection to Scopus, ScienceDirect, and Google Scholar may exclude high-quality technical reports or local journals. This might limit the comprehensiveness of the review by omitting valuable insights found in other publication formats (Nandasena et al., 2022). The technologies analysed primarily focused on AR, VR, GIS, and HBIM. In contrast, other emerging technologies, such as Artificial Intelligence (AI), blockchain, and big data, were not discussed in depth despite their potential to contribute to heritage tourism.

In terms of geographical scope, most case studies are centred around UNESCO-recognised cities, overlooking the potential and challenges faced by smaller towns, resulting in a lack of information that also has historical value. Furthermore, the rapid development of digital technology may render the findings of this study outdated within a short period. Continuous research is therefore essential to ensure long-term relevance and practical impact. Despite these limitations, this study still provides a clear picture of trends, gaps, and best practices in digital technology for heritage architectural tourism.

Suggestions for Future Research

This study identified significant gaps in the preservation and promotion of architectural heritage, particularly in non-UNESCO cities and underexplored rural areas. Therefore, future studies should focus on the use of digital technologies in this context to ensure a more inclusive and comprehensive strategy. A key recommendation is to extend the study to smaller towns with heritage architecture that are under-promoted. Technologies such as VR, AR, and digital platforms can be used to document and enhance the attractiveness of heritage tourism in these areas. In addition, there is a need to explore other new technologies such as AI, big data analytics, digital twins, and blockchain. These technologies can increase the efficiency of heritage conservation, such as AI that can analyse visitor data and blockchain that can authenticate digital heritage. Future studies should also investigate the impact of digital technologies on local communities, including their effects on cultural sustainability and economic well-being. Longitudinal studies are needed to assess the long-term effectiveness of digital technologies in preserving and promoting heritage sites. By exploring this aspect, future research can develop more innovative and sustainable solutions for preserving global architectural heritage.

Abbreviations

PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SLR	Systematic Literature Review
PICO	Population, Intervention, Comparison and Outcome
AR	Augmented Reality
VR	Virtual Reality
3D	Three-Dimensional
GIS	Geographic Information System
BIM	Building Information Modelling
HBIM	Heritage Building Information Modelling
LiDAR	Light Detection and Ranging
UNESCO	United Nations Educational, Scientific and Cultural Organization
UTAUT	Unified Theory of Acceptance and Use of Technology
IoT	Internet of Things
AI	Artificial Intelligence

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