



Digital Transformation in Heritage Tourism: An Assessment of AI Applications in Karnataka

Dr. Nutan S. Desai

Faculty, Department of History, RCU's Sangolli Rayanna First Grade Constituent College, Belagavi

Dr. Appanna N. Jirnal

Faculty, Department of Sociology, RCU's Sangolli Rayanna First Grade Constituent College, Belagavi

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ABSTRACT

Artificial intelligence is changing how we protect, explain, and experience heritage sites. Karnataka has three UNESCO World Heritage Sites and more than 1,450 protected monuments. It is now a leading Indian state in using AI for heritage tourism. This article looks at how AI is being used in Karnataka's heritage sector in four main areas: 3D digital scanning and virtual tours of over 530 monuments; Satellite-based tools to study old archaeological sites, used in the town of Lakkundi; Generative AI that creates immersive experiences for visitors, including virtual walkthroughs; AI-powered digital platforms for the public, like the One TAC platform. The study uses government policy documents, official project reports, and compares them with other national AI projects in cultural heritage. It checks what is working well and where there are problems. The findings show that Karnataka has done well in creating digital records of monuments. However, turning these digital records into better on-site experiences for visitors and attracting more foreign tourists is still a challenge. The article points out three main gaps: AI is not well connected to on-ground facilities, there is little use of AI chatbots to help tourists, and

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there is no clear rise in foreign tourist numbers. The article ends with suggestions for a step-by-step plan that focuses on people. It recommends balancing new technology with practical access and involving local communities.

Introduction

Using artificial intelligence in heritage tourism is more than just following a tech trend. It has become necessary for the future. UNESCO says that digital tools can make cultural heritage available to more people, help predict and prevent damage to old sites, and create new ways for visitors to engage, even if they cannot be there in person. The Indian government is also promoting the use of AI, augmented reality, and virtual reality to protect heritage sites and digitize museums. At the national level, projects like the updated Indian Culture Portal with its AI chatbot “Bharti,” which works in 22 Indian languages, and Google’s “Talking Tours India Edition,” which covers over 200 famous places, show how AI is growing in the heritage field. Karnataka holds a special place in this area. The state has many heritage sites, including three UNESCO World Heritage Sites Hampi, Pattadakal, and the Hoysala temples at Belur, Halebidu, and Somanathapura. It also has 844 state-protected monuments and about 25,000 more sites that are not officially protected. Karnataka’s Tourism Policy for 2024-2029 makes digital transformation a key goal. The plan includes building a digital tourism platform with AI-based travel suggestions and smart ticketing. However, turning this plan into real benefits for visitors is still happening slowly and has not been studied enough.

Digital Documentation: Scanning Karnataka’s Monuments

Any plan that uses AI for heritage sites must start with good digital records. Without clear, 3D digital copies of monuments, things like virtual tours, predicting damage, and AI-based explanations cannot work. Karnataka has done very well in this area and is now a leader in India. Between 2021 and 2024, the Karnataka State Council for Science and Technology (KSCST), working with the Department of Archaeology, Museums and Heritage (DAMH), completed 3D laser scanning of 530 protected monuments in the Bengaluru, Mysuru, Kalaburagi, and Belagavi regions. This made Karnataka the first state in India to scan most of its state-protected monuments in 3D. The scanning captured details that are usually hard to see, like the designs on ceilings and the tops of pillars. As Devaraj A, Commissioner of DAMH, said, it recorded parts of the monuments “not normally visible to the naked eye.” For Hampi, a UNESCO World Heritage Site, KSCST scanned 80 monuments and built a full digital map database. This is a big technical

achievement. The high-resolution LiDAR scanning creates very accurate 3D models, correct to the millimetre. These digital copies, or “digital twins,” can be used for repairing buildings, checking their structure over time, and teaching people. Besides the 530 state-protected monuments, the Archaeological Survey of India (ASI) has also digitally recorded its 609 centrally protected sites in Karnataka. This means most of the state’s officially recognized heritage now exists in digital form. The government says this data will be freely available for public use, so people can create new content and engage more with these sites. However, there is still a big gap between collecting this digital data and actually using it. Just having digital archives does not automatically improve the visitor experience or bring in more tourists. Karnataka needs to build a stronger connection between digital documentation and real-world use and so far, only part of that connection has been made.

Generative AI and Immersive Heritage Experiences

The most noticeable use of AI in Karnataka’s heritage tourism is in creating virtual tours using generative AI and 3D technology. In mid-2024, the Department of Archaeology, Museums and Heritage (DAMH) announced a project to make 3D walkthroughs of 10 selected monuments using “3D Immersive and Generative AI technology.” The project has a budget of ₹1 crore. The chosen monuments include the Virupaksha Temple in Hampi, the Varahaswamy Temple in Mysuru, the Lakshminarasimha Temple in Bhadravati, Shor Gubaz in Kalaburagi, and others from different parts of the state. Each virtual walkthrough will be 3 to 5 minutes long and will include narration about the history and architecture of the site. DAMH has bigger plans beyond these 10 monuments. After finishing the 3D scanning of 530 sites, the department wants to create virtual tours for all of them and upload them to its website. In a more advanced step, DAMH also plans to bring Karnataka’s protected monuments into the metaverse. This means people could explore detailed 3D models of the sites in a virtual reality environment from anywhere in the world. However, there are some clear limitations. First, these virtual tours are meant mainly as marketing tools to encourage people to visit the real sites. DAMH says the goal is “to create interest among people experiencing the virtual tour to actually visit the site, which will boost tourism.” But there is no solid proof yet that this actually works. Second, for now, only 10 monuments will have virtual tours. It is not clear when or if the other 530 scanned sites will be covered. Third, the metaverse plan is technologically advanced, but it raises questions about access. Not everyone has VR headsets or fast internet needed for such experiences, so many people may not be able to use them.

Satellite Imaging and AI for Buried Heritage

One of the most advanced uses of AI in Karnataka's heritage sector is using satellite images and geospatial AI to find buried ancient structures. The historic temple town of Lakkundi in Gadag district is a good example. It is famous for having "101 wells and 101 temples" from the Kalyani Chalukya period, between the 10th and 12th centuries. Now, it is being used to test this new technology. The project brings together the National Institute of Advanced Studies (NIAS) in Bengaluru, scientists from ISRO, and local authorities. They use satellite imaging to find hidden structures under the old town. This work is part of the KASTURI portal, which stands for Knowledge-base of Archaeology and Heritage using Spatial Technologies: Unified Resource for India. KASTURI combines satellite images, GIS maps, old records, and field surveys to spot hidden cultural sites. It is hosted on ISRO's Bhuvan platform and can detect things like buried water systems, old fort walls, settlement boundaries, and ancient roads that are no longer visible on the ground. The idea is simple: even after buildings disappear, they leave traces. Satellite images can show these traces through changes in soil moisture, plant growth, and the shape of the land. Professor M.B. Rajani, who leads NIAS's geospatial heritage project, has shown how this method can be used in Lakkundi to map temple groups, stepwells, water systems, and other buried remains. The results have been impressive. Since 2023, more than 70 monuments have been found in Lakkundi, including 32 temples, 28 wells, and 7 other structures. During excavations in November 2024, over 1,500 artifacts were found. A second round found 1,800 more. Officials expect that over 5,000 artifacts will eventually be documented and displayed in a planned open-air museum. This use of AI and satellite technology solves a big problem in archaeology: you cannot dig up every possible site. By using satellite data to find the places most likely to have important remains, experts can save time and focus their conservation efforts. At the same time, the state government is pushing to get Lakkundi added to the UNESCO World Heritage list and has started ₹10 crore worth of conservation work on six monuments.

One TAC: Building Digital Public Infrastructure for Heritage Tourism

While other technologies help with conservation and virtual visits, the OneTAC initiative focuses on improving services and making things easier for visitors. OneTAC, which stands for Tourism, Arts, and Culture, was launched in April 2025. Its goal is to create a single digital system for Karnataka's tourism, arts, and culture sectors. The platform is designed to bring everything together in one place. It will create a statewide digital list of cultural assets, performers, heritage sites, tour guides, venues, and service providers. Folk artists, homestay owners, travel guides, and transport operators will get digital IDs and verified credentials. This will make it easier for tourists to find, book, and pay for services using open and connected

systems. The platform will also include business-to-business marketplaces and virtual helpers to assist vendors and artisans in joining the system. AI plays a key role in OneTAC. The platform will use AI assistants to give tourists real-time, local cultural recommendations, acting like a digital guide. It will work in a similar way to the Bharti chatbot on the national Indian Culture Portal. Data tools will also track travel trends and help the government make better decisions about tourism. To manage this, the government is setting up the Karnataka Tourism, Arts, and Culture Mission (K-TAC) as a public-private partnership. An advisor will guide the design of the OneTAC system, including its technology, rules, and how it will be run. The plan is to start with pilot services like registries for tour guides and homestays, and then expand across the state. OneTAC is trying to solve a real problem: Karnataka's heritage tourism services are scattered and not connected. Right now, if a tourist wants to hire a licensed guide, book a homestay near a heritage site, or find a local artisan, there is no single place to do it. Information is spread across different websites, social media, and word of mouth. By bringing verified providers together and allowing digital payments, OneTAC could help more local people benefit from tourism. But whether OneTAC succeeds depends on how many people use it. Will thousands of small homestay owners, independent guides, and folk artists have the digital skills and tools to join? Will the AI recommendations be good enough to make tourists choose OneTAC over apps like Google Maps or TripAdvisor? These questions will only be answered once the platform is fully launched.

Persistent Gaps and Critical Challenges

Karnataka has high-quality digital records of over 530 monuments, but most of this data is still not available to the public. Only 10 monuments are planned for virtual walkthroughs in the first phase. The rest are stored as technical files on KSCST servers and are not being used for tourism, education, or to help with conservation planning. This means a valuable resource is not being used properly. What's needed is a clear plan to turn this data into useful content. The gap between virtual and real experiences.

Virtual tours are meant to encourage people to visit the actual sites. But they cannot fix problems with on-site facilities. A tourist who sees an amazing 3D walkthrough online may still face bad roads, poor parking, dirty toilets, and little information when they arrive at the site. Technology cannot replace basic amenities. For digital projects to work, the government also needs to invest in physical infrastructure. The gap in tourist-facing AI.

Apart from the AI assistants planned for OneTAC which are not running yet Karnataka has not launched any conversational AI to help tourists before or during their visit. Tourists cannot ask a chatbot about opening times, ticket prices, or the history of a site. They also cannot get personalized travel plans based on

what they like. Compared to national projects like Bharti or Google's Talking Tours, Karnataka's direct AI support for tourists is still underdeveloped.

Future Directions and Recommendations

For the future, Karnataka's AI heritage tourism strategy should focus on three key areas:

- 1. Finish and share virtual tours:** The pilot project with 10 monuments should be expanded quickly to cover all 530 scanned monuments. These tours should be free and available on multiple platforms like the DAMH website, the Indian Culture Portal, and Google Arts & Culture. Making the 3D models open for public use would allow other developers to create educational apps and new ways for people to experience the sites.
- 2. Add AI tools for visitors on-site:** Augmented reality apps should be introduced so visitors can point their phones at a monument and instantly get information about it. A similar AR project is already being developed for Hampi. This could be tested first at popular sites like Mysuru Palace and Hampi. QR codes at key monuments could also link to narrated, AI-generated stories in different languages.
- 3. Use satellite AI for heritage management:** The Lakkundi model, which uses satellite images and geospatial AI to find buried heritage, should be expanded to other parts of the state that are not well documented. This is especially important in northern Karnataka, where many unprotected sites are still waiting to be discovered.

Conclusion

Karnataka has become a leader in using AI for heritage documentation and virtual access. Scanning over 530 monuments in 3D, using generative AI for immersive walkthroughs, applying satellite-based AI to discover sites in Lakkundi, and planning the OneTAC digital platform all show a strong investment in technology. These projects address real needs: preserving records for conservation, giving people virtual access from anywhere, and organizing services for local providers. The main challenge now is to connect these efforts and bring them to completion. The digital records need to be turned into experiences that visitors can easily access. Virtual tours should go hand in hand with better on-site facilities. AI assistants need to move from plans on paper to actual use. Most importantly, the success of any technology in heritage tourism should not be judged by how advanced the technology is. It should be judged by how it improves the visitor's experience whether a tourist leaves with better understanding, greater appreciation, and a reason to come back.

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