

Potential to Utilize Digital Twin Technology in Conserving Cultural Heritage within the Built Environment of Sri Lanka

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The "digital twin" concept has gained prominence in architecture and construction for maintaining accurate digital representations of physical structures. There is no generalised digital twin system which can be applicable for all purposes; thus, the digital twin development is context and site-specific. Building Information Modelling is invaluable for performance modelling, behaviour analysis, and preventive maintenance of historic sites, yet its implementation complexities demand customized approaches. In Sri Lanka, digital twin adoption lags due to uncertainties in construction, operation, utility, and limited research on their cultural heritage impacts. Modernization threatens colonial street architecture, intensifying conservation urgencies. Digital twins offer detailed virtual models capturing architectural nuances and historical contexts, crucial for UNESCO World Heritage sites facing modernization and climate change threats. The UN's 2030 Sustainable Development Goals prioritize cultural and environmental sustainability, underscoring the need for effective conservation strategies. This study used a literature review, two case studies with a detailed algorithm for the creation of a digital twin, and professional interviews for identifying challenges and strategies for digital twin implementation. Case studies of the De Soysa building and Rangiri Dambulla Caves illustrate their potential respectively: the former preserving legacy amid urban development, the latter optimizing preservation through microclimatic analysis. Project-specific digital twins are pivotal for safeguarding cultural identity and managing heritage properties. Challenges in digital twin use for heritage preservation include data capture, costs, integration, and ethical considerations. Solutions entail advanced technologies, funding strategies, standard data formats, cloud storage, and ethical data handling to enhance management and preservation.

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