Digital Modelling for Climate Resilience

Australia's cultural heritage is increasingly under threat from climate change. The Old Great North Road (OGNR), a UNESCO World Heritage site, faces structural degradation due to intense rainfall, fires, and environmental stressors. This project, funded by the Australian Heritage Grant (AHG 2021) aimed to digitally preserve the OGNR through advanced documentation, modelling, and immersive engagement. Digital heritage tools offer a sustainable and replicable approach to heritage conservation, especially where physical access, structural instability, and climatic threats converge.

Why the study:

- OGNR, a UNESCO World Heritage site, is increasingly vulnerable to climate-induced hazards such as intense rainfall, bushfires, and environmental degradation.
- Physical inaccessibility, structural instability, and climatic volatility necessitate innovative preservation methods that go beyond traditional conservation practices.
- Digital heritage tools, including 3D scanning and VR, offer a sustainable, replicable approach to documenting and safeguarding heritage assets in Australia and globally.

What we did:

- The project developed a **three-phase digital framework** combining:
- Drone aerial mapping, 3D laser scanning, and photogrammetry to capture data from key OGNR precincts.
- Advanced digital modelling to process high-precision data into textured meshes and point clouds.
- Immersive VR simulation using Twinmotion and Oculus Quest 2 to create a virtual representation of the heritage site under climate stress scenarios.

What we found:

- Vulnerability Mapping: Rainfall-induced erosion and bushfires are significantly degrading key features (culverts, retaining walls, convict graffiti, wedge/jumper marks).
- Digital Tools Efficacy: The integration of laser scans, BIM, and VR enables not only structural diagnostics but also public engagement and educational applications.
- Framework Validation: The developed framework provides a scalable methodology for real-time monitoring, adaptive conservation planning, and public storytelling.

What this means:

- A replicable digital conservation framework for other climate-threatened heritage sites.
- Enhanced public engagement through immersive VR to raise awareness and understanding of climate impacts on cultural heritage.
- New conservation strategies incorporating predictive climate modelling, real-time monitoring, and multi-stakeholder involvement.

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