Case study: uTwin, University of Texas at Austin

Institution: University of Texas at Austin (UT Austin), United States of America

Partners: Texas Advanced Computing Center (TACC), UT Facilities, City of Austin, Bentley Systems

Focus: Data-driven urban digital twin for building performance, environmental planning, and public engagement

Bentley tools featured: OpenCities Planner

Overview

UTwin is a data-centric, campus-scale digital twin developed at the University of Texas at Austin. Designed to integrate a wide variety of datasets, including environmental, infrastructural, and spatial information, UTwin provides a visual decision-support tool for researchers, students, and the public.

The twin is optimized for accessibility and performance rather than high-fidelity geometry, focusing on real-time data exploration and public communication. While initially created for research, the twin is now publicly accessible via a web interface using GitHub Pages, providing stakeholders a live view of metrics such as air quality, energy consumption, and flood risk.

Data integration and processing

Data sources

UTwin integrates data from:

- building energy consumption datasets
- air quality sensors across campus
- GIS layers for transportation, hydrology, and green infrastructure.

Processing tools

Python libraries such as Pandas and GeoPandas were used to clean, standardize, and process shapefiles and tabular data. These datasets were uploaded into OpenCities Planner for map-based visualization.

Visualization and deployment

OpenCities Planner served as the primary platform for building and sharing the twin. It supports the integration of:

- 3D models (simplified for browser use)
- vector overlays and base maps
- interactive points of interest (POIs) linking to external dashboards or documents.

The final output is deployed as a public-facing web application with optimized content delivery for low-bandwidth users and lower-spec devices. This ensures the tool remains inclusive and usable for diverse audiences.

Education and public engagement

UTwin was developed as both a research and communication tool. Its open-access format allows:

- faculty and students to explore sustainability scenarios
- city planners to examine environmental risks in an academic sandbox
- citizens to understand local air quality and building performance trends.

It acts as a learning resource, enabling non-specialist users to engage with urban data in a meaningful way.

Outcomes and impact

- Integration of live and historical datasets into an interactive platform
- Enhanced public understanding of energy use and environmental conditions
- Demonstrated a low-cost, replicable framework for urban-scale digital twins
- Reinforced UT Austin's leadership in civic digital innovation

Key lessons

- **Start with available data:** Low-cost tools like Python and GitHub Pages can create powerful results.
- **Optimize for audience:** Prioritize web performance and clarity over graphical fidelity.
- **Use open-source wherever possible:** Maximize transparency and replicability.
- **Engage students and the public early:** A twin is more impactful when it's shared.