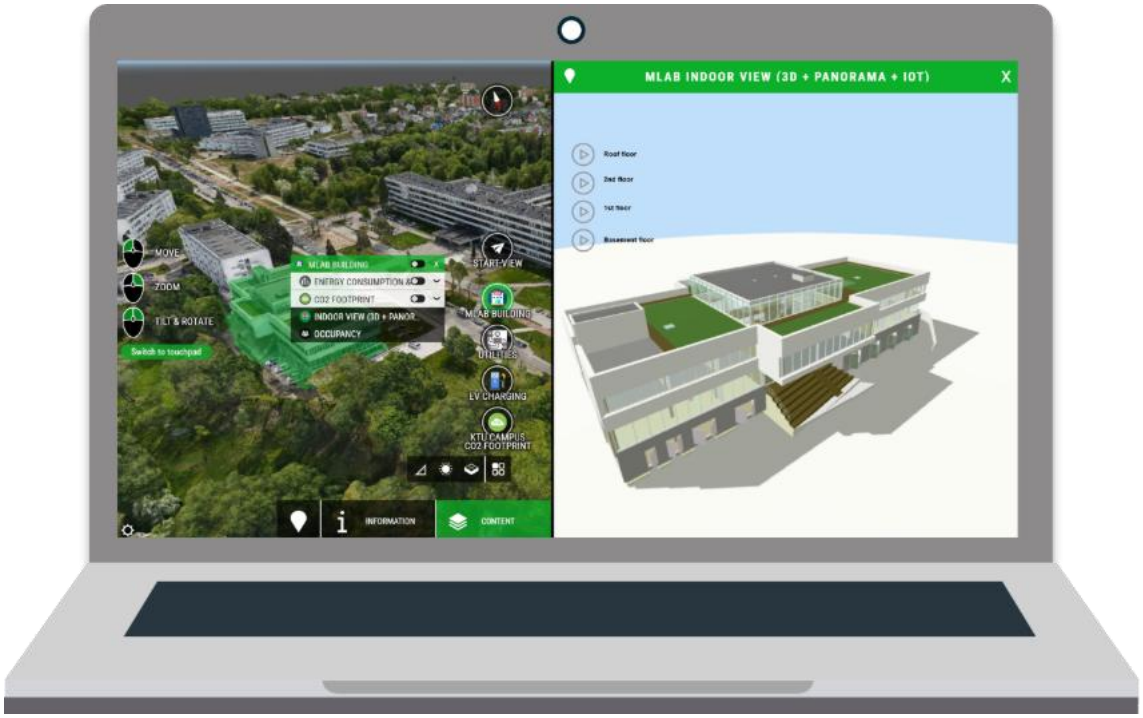
Case study: Kaunas University of Technology (KTU)

Institution: Kaunas University of Technology (KTU), Lithuania

Partners: Bentley Systems, Digital Construction, YIT Lietuva, Kauno Tiltai, Staticus, Inhus

Focus: Sustainability-driven digital twin for education, emissions reduction, and city-scale planning

Bentley tools featured: iTwin Capture Modeler, OpenCities Planner, iTwin Platform



Overview

Kaunas University of Technology's digital twin initiative, developed through its Centre for Smart Cities and Infrastructure, demonstrates how academic–industry collaboration can enable innovation in sustainable infrastructure and education. Originally developed as a campus-scale pilot, the twin has expanded to cover parts of Kaunas city and is used as both an emissions monitoring tool and a teaching platform.

Driven by Lithuania's goal of decarbonizing its building stock by 2050, the project integrates UAV-based photogrammetry, LiDAR, IoT streaming, and BIM to visualize and optimize building performance. The campus digital twin acts as a real-world sandbox to support CO_2 emissions reduction, smart infrastructure development, and digital skills transfer into industry.

Data acquisition and modeling

Reality capture: The project began with the systematic capture of both exterior and interior spaces. UAV-based photogrammetry and terrestrial LiDAR were used to create reality meshes of campus buildings. These 3D datasets were later enriched with BIM models and mapping data to provide spatial and semantic context.

Model use in education: Students access these digital models to contextualize architectural and engineering designs. Several faculty members embed the twin into coursework, bridging theoretical content with hands-on experience.

Live IoT integration

KTU has built a system that integrates IoT sensor data into the digital twin for real-time monitoring and feedback. These include:

- air quality and human comfort indicators (temperature, humidity)
- energy performance and production (e.g., photovoltaic outputs).

The aim is to create and monitor sustainability indicators to support long-term building performance optimization.

City engagement and expansion

Initially focused on campus buildings, the digital twin expanded into Kaunas city center. The Centre for Smart Cities and Infrastructure is now advising the city on how to replicate the model at scale. While city authorities were initially hesitant, demonstrator projects have illustrated the benefits of using digital twins for urban planning.

Teaching through innovation

KTU's digital twin acts as an engine for digital skills development. Architecture and civil engineering students explore:

- open standard modeling using IFC
- safety analysis and infrastructure design
- sustainability strategies and emissions analysis.

Notably, the MLab prototyping building was built and analyzed using the digital twin. Students engaged in real-time design assessment, HVAC and utility integration, and safety modeling, applying classroom knowledge in a practical context.

Outcomes and impact

- A dynamic 3D model of KTU's campus and Kaunas city center
- Integration of IoT sensors for real-time sustainability monitoring
- Deployment in academic curricula for architecture and civil engineering
- Uptake of digital twin use by local government and developers
- Support for emissions reduction in line with EU building directives

Key lessons

- Digital twins support both infrastructure and education goals simultaneously.
- UAV photogrammetry and LiDAR offer scalable, accurate data capture.
- Open standards like IFC enable model longevity and interoperability.
- Live sensor data enhances model value and supports sustainability metrics.
- Partnerships between industry and academia drive meaningful innovation.