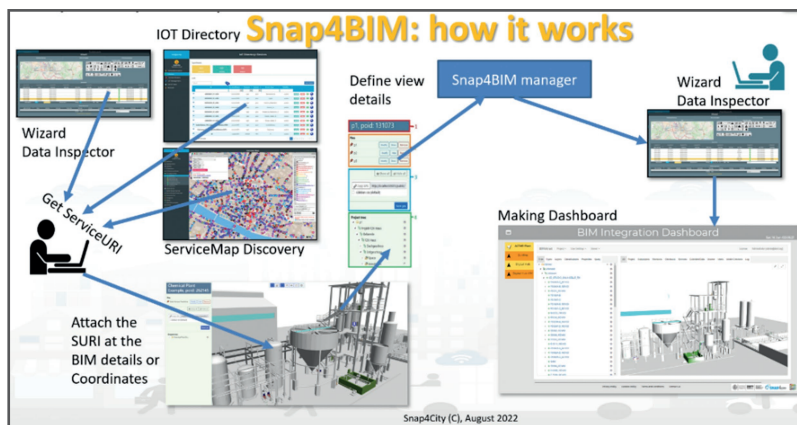# Snap4City Digital Twin (2024)

Digital Twin for Urban Modeling with Artificial Intelligence and Simulation

SOLUTION

For Digital Twin / CityVerse we intend the modelling and management of physical entities with digital entities, by monitoring, simulation and control. In the context of cities and industries we can have a digital counterpart describing all aspects including data flow, time series, structural details of the design, control and functional aspects, and also 3D shapes to see them in the 3D representation in digital https://www.snap4city.org/749 . The Digital Twin local refers to local details of a building or of a single machine/area, while the Global refers to the coverage of the model among several entities. Data, and interaction can be on physical entities and provoke changes in the digital or viceversa, the two worlds should be actually twined, or merged, or better they should be the same thing, in some cases the digital model can be used to explore other cases, for example in simulation, optimisation, etc. Snap4City's comprehensive suite of tools and technologies offers a robust foundation for creating smart city solutions that are compatible with CityVerse, adhere to MIMs Plus standards, and utilize the DS4SSCC blueprint and the LDTs Toolbox. This integration promotes the development of innovative, interoperable, and impactful smart city projects. In Snap4City, Digital Twins are integrated with IoT Device Models, maps, heatmaps, structure, functional, services, and 3D representations, etc. They can be used for making changes into the virtual world and

see the action of the physical, or just to apply temporary changes to show them at the stakeholders, thus facilitating the decision-making process in close to realistic conditions.

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At level of Digital Twin local detailed aspects are modelled in digital of a physical element, for example of a chemical plant with machines, motors, silos, etc., each of them with 3D representation, detailed components, and real-time values of sensors attached which can be used to understand its behaviour in terms of real-time data and functionalities, mechanical parts to be disassembled for maintenance and inspection, etc. Several different levels of resolutions can be provided and the rendering is typically performed on 3D modelling and visualization

tools such as the BIM Manager (https://www.snap4city.org/730). The 3D shape is obtained by starting from formats such as IFC, DXF, SVG (Scalable Vector Graphics), STEP, IGES, STL (Stereolithography), OBJ (Wavefront), DAE (Collada), SCAD (OpenSCAD), and IV (Inventor). The Local Digital Twin also may include the detailed description of floors, detailed description of data, devices, etc.

Snap4City provides support for creating Global Digital Twin of the city with integrated Local Digital Twins, it is part of the Dashboard Builder of Snap4City which is 100% open source. It is possible to pass from Digital Twin to the Local Digital Twin such as "entering in the detailed view". The 3D representation and view of the Digital Twin in Snap4City can manage multiple layers on the map with different levels of opacity.
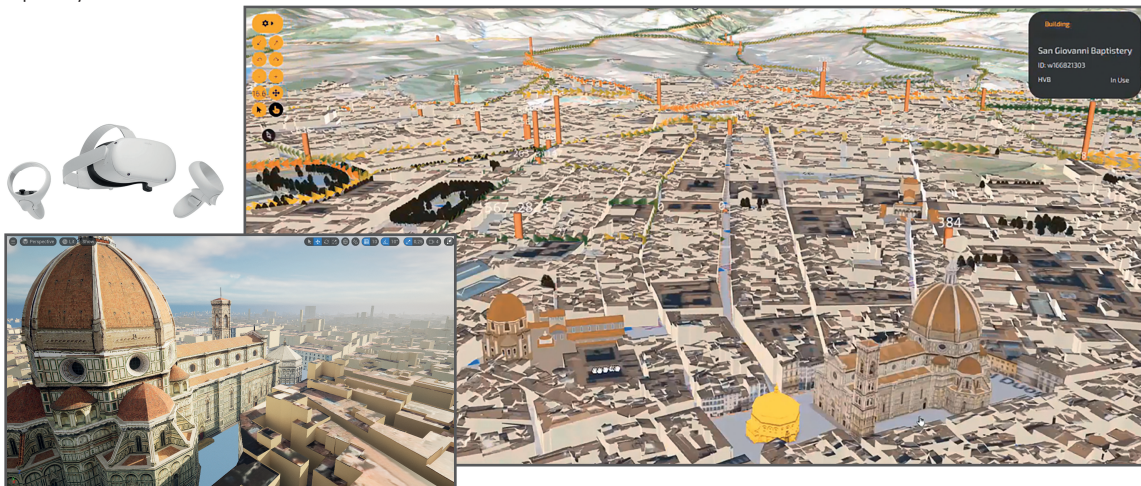
Snap4City 3D City Modelling Framework for Smart City Digital Twin is covering terrain elevation, roads, building planimetries, maps, orthomaps, heatmaps, buildings, high-value buildings with meshes, building extrude from their plant shape, roof reproduction from LiDAR data, pattern extraction and positioning for roofs and facades, traffic flow data, IoT Sensors/actuators, POI, traffic flows, bus routes, cycling paths, building, scenarios, optimisation, what-if analysis, etc. The LDTs Toolbox provides methodologies and tools aim at creating and managing Living Digital Twins of urban environments. Snap4City's features, such as advanced analytics, simulation, and visualization technologies, complement the LDTs Toolbox by enabling the development of dynamic and interactive digital twins. Snap4City can simulate real-world scenarios, support decision-making processes, and facilitate urban planning and management, all while being integrated with the broader smart city ecosystem. Interoperable Data Spaces: Snap4City's platform is built on open standards and supports the creation of interoperable data spaces for smart cities, as a secure and unified marketplace for data that promotes the development of new products and services.

https://www.snap4city.org/dashboardSmartCity/view/Baloon-Dark.php?iddasboard=MzQzMQ==
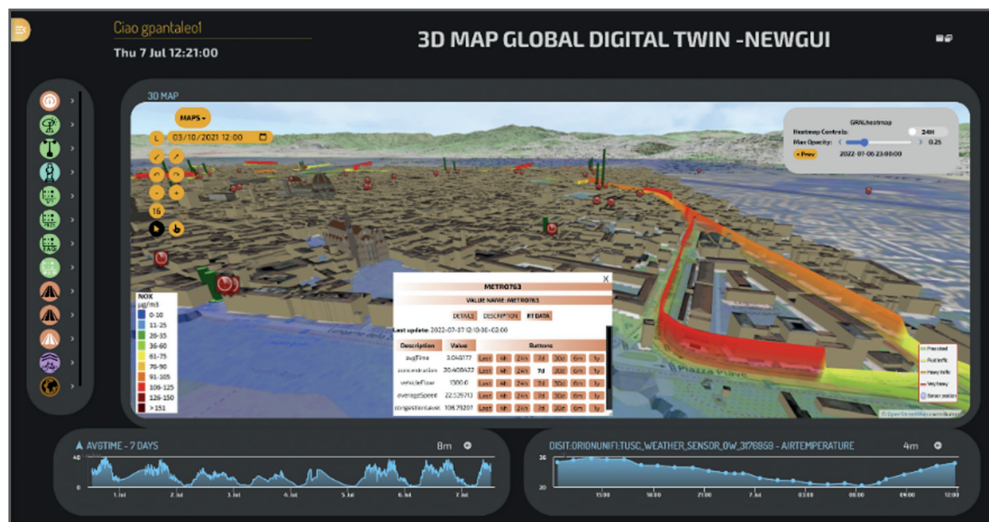
Snap4City provides an efficient and cheap approach for (i) the production process from raw data to 3D Digital Twin elements, (ii) the integrated model for Digital Twin representation and distribution on the web, (iii) the performance in production and distribution of the resulting integrated Digital Twin model. The 3D representation is enriched with: a 3D representation of crests for traffic flows, 3D shapes, and dynamic PINs which can manifest data values for real-time IoT data representation, heatmaps, and animations, picking functionality for building and data elements, and interactivity with all the elements from dashboards.

Extended version accessible from: https://www.snap4city.org/749
Contact: https://www.snap4city.org
https://digitaltwin.snap4city.org/
Partners: Snap4City, DISIT Lab