52. Beyond BIM modeling: from 3D survey to Environmental Sensor Data Integration for Building Monitoring. The Case Study of Energy Center

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The increasing availability of reality-capture technologies and environmental monitoring systems offers new opportunities to develop integrated digital environments for building management. However, geometric survey data, Building Information Models (BIM), and sensor measurements are frequently managed as separate information layers, resulting in limited interoperability. This research presents a workflow that integrates 3D metric survey, Scan-to-BIM methodologies, and a simulated time-varying exchange of environmental data within a BIM-based framework. The selected case study is the Energy Center building of Politecnico di Torino, where 63 virtual sensor instances were configured with room assignments, dedicated parameters, and unique Registry IDs. At this stage, no live sensor streams or historical Energy Center measurements were used. A local MQTT-JSON-Dynamo chain was tested with simulated temperature, humidity, and air-quality values in a conference-room demonstrator. The results verify identifier-based association, parameter updating, and colorbased visualization without claiming an operational monitoring deployment. The study provides a methodological basis for future integration of physical sensor streams and for the development of accessible three-dimensional building-monitoring environments.