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Beyond 3D Models: Leveraging multiscale 3D Geovisualization and GeoBIM for Next-Generation PropTech Applications

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Abstract:

By synthesizing the architectural precision of BIM with the spatial intelligence of GIS, this approach elevates property data into a sophisticated 3D geovisualization environment within the GeoBIM framework. This fusion allows for the representation of complex indoor geometries alongside expansive outdoor terrains, creating a continuous spatial narrative in various scales. GeoBIM represents the powerful convergence of Geographic Information Systems (GIS) and Building Information Modeling (BIM), creating a unified digital environment that bridges the gap between a building's internal details and its external geographic context. For the real estate industry, this integration transforms the entire lifecycle of an asset—from site selection and feasibility studies, where developers can analyze topography, zoning, and local infrastructure in 3D, to long-term facility management. By layering high-resolution architectural models onto real-world spatial data, stakeholders gain a "single source of truth" that improves decision-making, reduces costly design conflicts, and enhances sustainability.

The authors, by integrating these technological frameworks, sought to develop a multi-scale analytical tool that enhances the Property Technology (PropTech) lifecycle. More specifically, an interactive web-based platform was created to visualize and manage property-related information within a three-dimensional environment. The research explores the potential of holistic representation of built-environment data across both micro and macro scales. By utilizing web-based rendering engines and creating an interactive 3D Geovisualization web application, the authors tried to present beyond raw architectural datasets and transform them into interactive, navigable landscapes. The 3D geovisualization layer does not merely display 3D shapes; it goes beyond 3D models by contextualizing assets with their true geographic coordinates, enabling potential customers to evaluate a property's relationship with its environment, all in a single immersive digital space. Leveraging the power of GeoBIM with 3D Visualizations elevates the user experience from passive observation to immersive exploration, effectively turning real estate marketing into a "digital twin" experience. For potential buyers, this means moving beyond simple 2D floor plans to interactive virtual walkthroughs that are accurately placed within their future neighborhood. They can simulate the solar orientation to see how light enters a room at 4:00 PM in different seasons or months or assess the true sightlines from a balcony to ensure an unobstructed view of the skyline.

A rigorous cartographic approach was applied to this 3D environment to ensure that the wealth of integrated data remains legible and actionable. Unlike traditional 2D maps, 3D cartography in PropTech must manage "visual noise" through techniques such as level of detail (LoD) management and thematic 3D coloring. By applying cartographic principles for visual hierarchy and color symbology to 3D objects, the application can highlight critical information, such as property boundaries, zoning violations, or price-per-square-meter variations. This ensures that the user is not overwhelmed by the complexity of the BIM data but is instead guided by clear, intuitive visual cues that prioritize the most relevant real estate metrics. Additionally, by integrating these 3D models with real-time urban data as traffic flow, and proximity to green spaces or other important facilities and infrastructures, can provide a transparent, "try-before-you-buy" environment. This level of spatial storytelling builds buyer confidence, as it replaces imagination or the buyer's "dream" with a precise, data-driven reality of what living in that space will actually feel like.

This research also explores the interoperability between BIM and GIS technologies, highlighting the potential of holistic representation of built-environment data across both micro and macro scales. It is evident that, by building on the structural depth of GeoBIM, a 3D geovisualization cartographic approach shifts the focus to how this complex data is synthesized and communicated through interactive, multidimensional visualizations. Unlike traditional static 2D maps, 3D geovisualization in real estate requires high-performance rendering and dynamic symbology to represent

multilayered variables, such as property valuations, environmental factors, urban mobility, and traffic, in ways that reveal hidden spatial patterns and evoke emotions in potential property buyers.

This approach moves beyond simple representation to exploratory data analysis, allowing to manipulate data or toggle between micro-level building views and macro-level urban proximity or heat maps. It transforms abstract architectural and spatial datasets into intuitive visual narratives, enabling investors to "see" the future impact of a development before a single brick is laid. This synergy between geovisualization and data-rich BIM enables users to engage in "spatial storytelling," viewing a building's physical attributes through a geographic lens. This approach transforms the WebGIS application from a simple viewing gallery into a powerful decision-support system, where the art of cartography and the science of GeoBIM provide a comprehensive understanding of real estate potential.

Figure 1. Daylight Animation of the BIM overlay to a drone-based 3D mesh of the area.

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