Administrative Big Data 3D Grid Voxel Data Construction Plan

Seo, Min Song
Researcher, Korea Institute of Civil Engineering and Building Technology (KICT), Goyang, South Korea

Jang, Yong Gu
Senior Research Fellow, Korea Institute of Civil Engineering and Building Technology (KICT), Goyang, South Korea

Ryu, Ji Song
Researcher, Korea Institute of Civil Engineering and Building Technology (KICT), Goyang, South Korea

Abstract

As digital transformation drives national competitiveness, the Republic of Korea is promoting policies to position itself as an AI-centered nation. These initiatives have expanded the potential application of AI in administrative data and highlighted the importance of integrating spatial information with big data to establish data-driven administrative systems. However, most administrative datasets remain two-dimensional, limiting their ability to represent complex spatial structures and analyze spatiotemporal changes. This study proposes a framework for constructing voxel-based administrative big data that incorporate spatial, vertical, and temporal dimensions. Administrative datasets and open APIs were systematically examined across aerial, surface, underground, and underwater domains and analyzed in terms of spatial reference, coordinate system, data format, update cycle, and attribute characteristics. Based on this analysis, a three-phase voxel data construction framework was developed: (1) data standardization and interoperability, (2) 3D gridding and voxelization, and (3) 4D spatiotemporal integration and visualization. The proposed framework enables high-resolution analysis of complex spatial phenomena and provides a technological foundation for establishing a 3D administrative information infrastructure that supports the Digital Twin National Land initiative and AI-based decision-making.