

A 2D-image-AI-based 3D Measurement for Prefabricated Prefinished Volumetric Construction

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There is a growing need to support prefabricated prefinished volumetric construction (PPVC) through 3D measurement to enhance efficiency in quality control. Currently, building model generation primarily relies on manual measurements to determine the properties of architectural, mechanical, electrical, and piping elements. While advancements in 3D scanning technology now enable the scanning of existing buildings, converting this scan data into usable models still requires significant human involvement due to challenges such as large data sizes, occlusion, and the presence of various structural elements. As a result, a more efficient method is needed to streamline 3D object detection and measurement from such complex datasets to enable fully automated scan-to-model generation. This work proposes an accelerated 3D component measurement strategy that improves efficiency by projecting 3D points with RGB information onto multiple continuously moving orthogonal 2D views, effectively reducing data complexity. The projected 2D images are then used for object detection training. Based on the object types and positions detected in multiple orthogonal 2D views, objects are segmented and re-projected back into the 3D space to enable 3D object modeling and measurement. The exact dimensions of the objects are determined through a multi-shape 3D geometry extraction process using the detected 3D bounding boxes. This approach significantly enhances the automation and accuracy of 3D measurement, making scan-to-model generation more efficient for PPVC applications.
