

From the Perspective of Economic Interests and Sunlight Requirements: A Workflow for Generating Spatial Layout Based on the Characteristics of Urban Villages

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Abstract

The urban residential land use in Chinese cities has shifted from incremental to stock planning, necessitating an enhancement in quality behind the quantitative expansion. The renovation of residential areas in urban villages encounters challenges in balancing investment and returns, as well as meeting sunlight standards. Therefore, this paper proposes a solution that utilizes sales volume and sunlight requirements as indicators to analyze the key parameters affecting the optimization of urban village residences, establishing a workflow for generating residential spatial layouts. Initially, an independently developed sunlight algorithm calculates the topographical range that does not affect the sunlight duration of external residences. Subsequently, data scraping is employed to deduce the level of the unconstructed residential spatial layouts. Then, the optimal spatial layout angle of the residences is determined, followed by the application of the knapsack algorithm to calculate the possible permutations and combinations of sales volume and residential layouts. After selecting a set of arrangement data, multiple satisfactory spatial layout schemes are generated based on an independently developed segmented sunlight algorithm and a residential multi-agent algorithm. The research findings indicate that the proposed solution can accurately calculate the sunlight duration at marked points in real-time, effectively determining the sunlight impact range on external residences; it also expands the profitability of residential schemes and increases total sales by approximately 5-10%. Additionally, it generates a substantial number of residential spatial layout schemes, offering decision-makers a wider array of choices. This study provides a conceptual approach for the transformation of urban villages into residential areas, demonstrating the feasibility and practicality of this method.

Keywords

Urban Village Residential Renewal, Residential Spatial Layouts, Sales Volume, Sunlight Algorithm, Multi-agent Algorithm