STUDY ON GREEN RENOVATION OF THE EXISTING SETTLEMENTS BASED ON BIM TECHNOLOGY PLATFORM

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Overview

The total amount of urban construction in China is huge, nearly half of which was constructed within the 30 years since the 1980s, when the economy started to grow rapidly. The highest proportion among urban construction is residential construction. Yet the existing buildings are old, of relatively low quality and has potential risks in terms of structure and safety, and their residents mostly are from middle-low income group. The previous renovation method of massive demolishing and building has, in a way, affected the stable environment of the city, and has given rise to economic, environmental, social issues, and at the same time rendered the old city devoid of vitality.

Green renovation research based on BIM simulation technology digitalizes the current situation with digital simulation technology, and runs a diagnostic analysis of the sections whose functions are to improve. Differential Evolution algorithm (DE hereafter) is applied to screen and select the most suitable green technology according to the requirements of different stakeholders, and thus making different renovation plans per local conditions, including Minimum intervention, minimum cost, maximum energy consumption reduction, most comfortable level, etc. This would save considerable amount of trial and error costs, and poses a positive effect on the society and economy. The market demand of this technology is estimated to be vast.

Methods

This study first used BIM technology to fill the blanks in preliminary data, and then parameterized the relevant measures and technologies of residential renovation with the DE algorithm, which has the advantage of solving optimization problems in a complex situation, that conventional mathematical programming methods do not have. This study performed simulations according to the reequipments of different stakeholders (such as real estate developers, owners, government and property management organizations), selecting the corresponding measures and technologies that satisfy ‘nearest to the Pareto

optimal boundary, most uniform boundary distribution, covering the entire Pareto boundary'. The best renovation plan was determined in this way.

Finally, a community in Tianjin was selected as a case study to test the performance of the simulation. Three calculations were made, each from the perspective of government, real estate developers and owners. The three cases were then calculated again, and a final set of parameter values of the renovation plan was made.

Results

Considering the decision-diversity within the issue of residential renovation, and the complexity of function enhancements, the previous linear algorithm is not sufficient in dealing the current situation and therefore, BIM technology and DE algorithm are introduced in the simulation process of designing residential renovations, to 1) fill in the blanks of pre-existing residential area data, and 2) add to the insufficiency of function enhancement, and make a collection of renovation measures and technologies.

Conclusions

The renovation of existing residential area involves the benefit of multiple stakeholders, and it cannot be satisfied if the renovation methods and technologies are chosen merely per the experience of the designer or government decisions. Therefore, introducing BIM technology in the beginning phase of renovation to summarize and process the current situation, and introducing evolutionary algorithm to select the best measure and technology as the final proposed scheme is necessary and effective, within the current China context.

References

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