Urban Environmental Management with AI-assisted Design

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Abstract. In existing urban environmental management system, the information asymmetry can be problematic, and lead to situation that the demand and supply of urban environmental design does not meet with each other, causing the waste of social resources. We introduce City360 platform, combined with AI design technology, to help create different strategies accommodating to various interest groups after gathering their specific information, improving environment design and urban environmental management efficiency greatly.

1. Introduction

The world we live in is an increasingly urban one as cities currently account for half the world’s population. By 2030, it is expected that three out of every five people will live in an urban environment. With the rapid development of Chinese economy, urbanization process in China has been expediting. As the political, economic and cultural role of urbanization development, cities are centers where a large amount of information gathers. Along with the brand-new phase for information technology, urban environmental management has brought about the transformation of urban structure and the acceleration of social development by combining with reliable information technology. [1] The informationization of urban areas has provided a solid foundation for the construction of global urban systems and economic globalization. Accordingly, it is an important issue to explore possible measures with information technology to promote urban functional development and industrial structural optimization.

Traditionally, there are severala factors that restrict the pinpoint urban environmental management as following: First, governors might pay excessive attention to methodological levels such as political forms, and be lack of insufficient understanding of urban emotional identity and cultural value; Second, with economic growth, dual economic structure, which is usually found in urban-rural areas, has created some inconsistent situation, which are growing more prominent recently. Social stratification is intensified, and the interest sakes are eclectic and complex. Third, population structure in China is increasingly complex, the various needs of different groups can not be comprehensively understood. Fourth, the governance goals of different governmental departments coexist under one situation. The linear division of groups by using hidebound methods actually leads to the waste of energy and social resources.

Urban environmental management requires a delicate and effective way to comprehensively improve the quality of urban governance and public services, and the informationization will serve as a backbone for the urban environmental delicacy management. By constructing an effective modern urban delicacy management information platform, urban management objects, processes, evaluation will be digitized, therefore, the management efficiency of modern cities can be greatly enhanced.

Information technology is of vital significance to the urban environmental delicacy management. Information technology can be used to achieve goals of resource sharing, information exchange, coordination, and intelligent development. To solve the problems brought about by the rapid
development of modern cities and the promotion of informationization, the delicacy management concept put forward by the industrial era is integrated into the urban management concept, and the problems encountered in urban environmental delicacy management are solved based on the information technology.

2 Existing problems in Chinese urban special and environmental management system

The transformation of the urban management needs innovation based on existing system. Before discussing approaches to achieve urban environmental delicacy management, it is necessary to list existing problems in Chinese urban special and environmental management system.

2.1 Existing Problems

From the perspective of urban management, it is necessary to trade off the demands from different groups. Urban space renewal involves multiple interest groups, such as government, street offices, spacious designers, local residents, etc. These groups hold different demands for certain space. It is a practical trial in urban management to figure out how to coordinate the interests of all parties mentioned above, to make reasonable decisions after analysis.

From the results of the spacious renewal, the mismatch between supply and demand and unfit construction to local conditions are ubiquitous. Most of the existing designs are not demand-oriented and designs often depend on designers’ personal preferences. The demands from local residents in most cases are ignored. The local residents, who interact with designed and renewal environment most, cannot express their needs precisely due to the lack of professional design knowledge, so they can't actually participate in spacious regeneration processes.

From the perspective of design efficiency, communication costs are relatively high under existing system. In traditional spacious design and renewal cases, the spacious function and intention of targeted environment are obscure for government departments and development departments. It is difficult for designers to hit buyers’ pinpoint immediately. If quantities of urban space are on the reconstruction list, existing system can be problematic, therefore, design efficiency should be enhanced and communication costs should be sapped with new approaches.

To sum up, we believe that to solve problems in urban environmental management is mainly to sap information asymmetry. As it is mentioned in the introduction, during the process of urbanization, the improvement of the urban information platform will play an unplaceable role in the long-term urban environmental development.

As information technology evolves, how does it most effectively combine with existing urban management system is considerable. As both the foundation and bridge of information project construction, the platform can gather demands from all interest groups and adopt proper environment designs accordingly. Relying on the platform, which provides bridges for the various groups involved in urban environmental management and urban spacious design, information asymmetry and resource asymmetry can be better balanced.

2.2 Approaches: Information Platform

To solve information asymmetric problems mentioned above, unilateral efforts would be weak, while participations from more interest groups would be much more fruitful. Making those who are not familiar with spacious design and environmental management, especially residents, to participate in space design processes, enhances their satisfaction towards the urban environment, which equals to the improvement of management efficiency.

The bottom-up approach of urban environmental management is the foundation and future form of urban delicacy management. Meanwhile, we realize the urban environmental delicacy management is a continuous and gradual process of improvement. To improve spatial information and visual technology can better backup urban management with informational means. In this process, the public, as the main body of the information database, are especially meaningful to play a role in the process of long-term residents' autonomy.
In the urban environmental design process, platforms can create different strategies accustoming to various interest groups after gathering their specific information. For example, the government call for channels of propagating information; residents need channels for expressing their appeals towards certain urban space; designers require show page to display their projects. Therefore, the information platform integrating all the needs mentioned above would be welcome[4].

Meanwhile, owe to the visual interface on the platform, it can provide intuitive and visual design picture for resident, governor groups, which in most cases are unfamiliar with design schemes[5]. The online case database and programs involved artificial intelligence can match the supply and need automatically and achieve design projects more visual for other groups except designers through interactivity. By adjusting variables like size, function, location and other elements, users can receive different spatial effects. At the same time, it makes environmental design more virtual and intuitive, reducing repetitive work and improve management efficiency.

3 Platform with Artificial-intelligence-assisted Design

We developed the City360(urp360.org) platform in response to various groups: the government's need to publish information; the residents' desire to express their claims; the designers' requirement to showcase their projects.

The ecological chain of City360 platform can be simply expressed as: “residents express their needs”-> “the government collects and renovates according to the appeals”-> “designers upload and display the planned project”-> “the government adopts the designer's plan and starts the construction”.

During the process, the platform interlocks residents, government, and designers, and reduces the cost of communication among different parties, offering the public a place to express their exact needs.

As we mentioned before, designers’ design in most cases cannot fit the requirement from buyers exactly at the first time. Therefore, we developed a set of artificial-intelligence-assisted design tools on the platform. With a few simple instruct variables, a simplified design picture can be automatically created and show up on the platform. After buyers pick up their appealing design directions, designers will then carry out a detailed design according to this simple version. Designers can be free from preparing several different designs in advance, which are repeated and labor-demanding work. At the same time, the standardized design method on the platform can also sap the workload of designers.

Because aspects of urban environmental design vary greatly, City360 platform now aims at the artificial intelligence design of piecemeal space in the city.

The base of artificial-intelligence-assisted design is quantifying the perceived environment and space. We collect existing piecemeal environmental space designs or planned designs, and classify them according to different aspects. Variables such as the actual people flow, spacious service life, construction cost and maintenance cost are set as the criteria for evaluating the quality of a piecemeal space design case, making the designing system more quantifiable and intelligent.

This system enables buyers, who are not familiar with the direct design, to generate the most suitable environmental space design with simple options. Buyers’ options cover all aspects of the design of the piecemeal space.

- Size: The size of the space is the original size calculated in square meters. According to characteristics of piecemeal space, they are initially divided into three levels: Large (more than 50 square meters), Liddle (20 to 50 square) and Small (less than 20 square meters).
- Shape: The shape of the space is divided into Linear, Scatter and Agglomerate. The Linear mainly refer to long stripe space sandwiched between the two buildings. The Scatter refer to small scattered areas, while the Agglomerate is space close to the square.
- Design Life: The design life is divided into two years, five years, ten years, and different years of use will affect the selection of recommended construction materials and the use of budget.
- Space: Environmental space is divided into Indoor and Outdoor. There are different design schemes for Indoor and Outdoor. For example, outdoor lighting will take into account variables
such as night lighting and climate factors.

- **Location:** The location of the space is currently in various districts and counties in Shanghai. We collect plans for each district and county, and tag them from different districts and counties.
- **Environment:** The environment where the space is located is divided into Commercial Area, Residential Area, Office Area and Mixed Area. The design style of Commercial Area and Office Area will be more modern commercial, the Residential Area will be practical and friendly, and the Mixed Area design style will be relatively neutral.
- **Function:** The functions that space demands, such as greening, socializing, fitness, culture, etc., are the choices of users for needs.

The above-mentioned options are only based on the initial situation of the current situation, we will optimize the iteration of our options, and strive to cover the main needs of users in the future.

After receiving users’ selected option, the back-end server will search three most related design solutions in the design database, adapt users’ different options to different weights, and calculate the highest rating one, which is the most suitable design solution to feed back to the users.

The user is able to see an overview of the recommended design, an introduction to this design, and the prefabricated assembly and budget used in the design. Even if users are dissatisfied with this plausible design, they can view other types of designs that also share relatively high adaptation rating, and choose one that best matches their original demands.

After selecting the plan, the government agency can publish his detailed design requirements, such as design address, contact information, budget, etc., along with AI provided preliminary design framework on the platform to recruit suitable designers to design the project further. Meanwhile, the platform also provides standardized construction building materials especially designed for environmental piecemeal space, which help simplify the construction process and design complexity and cut down the cost. Over time, residents can easily express their demands using existing platform, and designers are familiar with some of the design solutions that residents often like, avoiding unnecessary design costs.

### 4 Conclusion

Artificial-intelligence-assisted design is not a substitute for design, but a surrogate bringing efficiency and less workload. The platform combined with artificial-intelligence-assisted design technology integrates multi-party demands, solves the dilemma of information isolated islands, gathers spatial information resources, supports the environmental management decision-making, and provides convenient, low-cost, quality-optimized information services for governments, enterprises, designers and the public. Via platform management, urban environmental management efficiency has been improved, which means more efforts can be put into other cause of urban regeneration.

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