Research on Public Space Optimization of Intelligent Community based on User Requirements

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Abstract: Under the background of informatization, the function and structure of public space in intelligent community can no longer meet the requirements of community users. Through field survey, this study interprets the user demand reflected by various phenomena in the community public space, and preliminarily identifies the user demand items. Then, it uses the KJ method to classify the demand items. Guided by Maslow's hierarchy of needs, the requirements are integrated again by matrix analysis method to get the user's needs and on this basis the friendly strategy of public space design in intelligent community is proposed.

1. Introduction
Intelligent community is a new concept of community governance in the new era. The core content is to promote the information exchange between community residents and managers through the Internet of things technology, so as to provide more convenient services for residents. The core of the smart community is the "Internet of everything", that is, the application of the latest generation of information technologies such as big data, The Internet of things and the Internet. But so far, there is no unified definition of intelligent community[1]. In 2014, the Ministry of housing and urban rural development issued the "intelligent community construction guide" and proposed that the proportion of smart communities will exceed 50% in 2020. As the basic unit of smart city construction, intelligent community plays an important role in smart city construction and has been promoted and applied by governments at all levels[2].

Through investigation and research, it is found that the current research on smart community is mostly in the aspects of community information management system, service technology promotion and service product renewal, and community public space design as one of the basic modules has not been deeply explored. However, simple technological upgrading and product updating are not what users need most, and users' demands are not satisfied by single new technologies and products. Therefore, the research on community public space must be based on the main needs of community users, on which basis technology upgrading and product updating will be carried out, and the satisfaction of community users will be improved accordingly.

As the most basic unit of community governance abroad, foreign scholars mainly focus on comprehensive studies from the perspective of smart cities[3]. The research topics of domestic scholars on intelligent community mostly focus on theoretical carding, such as research on development status and prospects, top-level design of smart community construction, construction of smart community management platform, and realization of smart community functions. Generally speaking, the research on smart community can be divided into information technology level, community governance level and community service level. To sum up, the author thinks that how to design the public space of intelligent community under the background of informatization is a very important topic.
2. Current situation of public space in intelligent community

Community public space is not only public, but also regional. Community public space has a certain field scope, that is, completely embedded in the community internal public space. Its core function is to undertake the communication of community users and hold various activities, and the significance of its existence is to meet the needs of community users. In this study, the community public space is defined as the external open space in the internal space of the community and between the architectural entities. The demand of community users for outdoor public space in the community plays a guiding role in the application of information technology to the construction of intelligent community public space. Through the collation and analysis of the literature, it is found that the problems existing in the public space of traditional communities mainly focus on the following four aspects.

2.1. The allocation of public service facilities is unreasonable and the accessibility is poor.
The allocation of community public service facilities is not only poor accessibility, but also lack of scientific and diversity. In the traditional community, most of the service facilities in public space adopt the single average planning scheme of "thousand people index" and "service radius". The spatial location has strong subjective randomness, lack of systematic planning and layout, lack of public service facilities configuration or repeated construction. In addition, the spatial distribution of public service facilities is uneven, the service radius is not good, and the sharing ability is poor, which makes the physical accessibility of community public space lower. Residents' access to facilities is inconvenient, which has a direct impact on the use frequency of community public space. From the perspective of fairness, it is difficult to realize the balanced layout concept of "everyone enjoys".

2.2. The construction of community public space lacks inclusiveness.
Most of the community public space in China is mainly for young groups, and intergenerational community public space has not formed in a real sense. In the process of smart service promotion, too much attention is paid to the application of intelligent devices, while the follow-up relevant technical training and careful guidance are ignored. Due to the different cognitive level of each person, the phenomenon of disconnection between some people and new technology will occur in the community with relatively complex residential structure. This not only brings inconvenience to the vulnerable groups such as children and the elderly, but also fails to meet the needs of community residents for intergenerational communication and interaction in public space. Due to the different needs and interests of different age groups, the construction of community public space should form an overall inclusive environment for all ages, and at the same time, it should also give community residents a buffer period to adapt to new technologies.

2.3. There are serious homogenization and poor coordination in the design of community public space.
Affected by the rapid economic development, China has more than 200 million floating population, so it has become normal to work in different places and buy houses in different places. Therefore, people from all over the country may gather in the same community. They have different customs and cultural backgrounds, so-called thousands of people and thousands of faces. However, the design of community public space is similar to that of thousands of cities. The homogeneity of space construction is serious, and the lack of humanistic ideas does not take into account the material and spiritual needs of community residents. In the process of planning and building smart communities, there is a phenomenon that each organization is committed to developing its own information service system, which leads to a dedicated app for security, parking, etc., which will not only lead to duplication of data information and content, but also increase unnecessary use burden on community users.

2.4. Community identity and community belonging are increasingly missing.
The excessive concentration and commercialization of public space in the process of profit seeking leads to the blind construction of unilateral ignoring the needs of community residents. The material function
of community public space can’t be realized, so as to reduce the residents' identification of community public space. The lack of response to the material needs of community residents leads to the lack of basic conditions to enhance the interpersonal relationship and the sense of belonging in the community. The rapid pace of life and the increase of population mobility further alienate the interpersonal relationship of community residents. The indifferent interpersonal relationship makes the residents lack the sense of security when they get along with each other, and their initiative consciousness and enthusiasm to participate in public affairs will be greatly reduced, so they cannot have a sense of belonging.

3. Case analysis
The selection of Dufuying street community is mainly based on the three residential areas of Jinpeng apartment, Dufu new town and Zhongshan Lido, which are mainly high-rise buildings with different sizes, and there are some problems in public space. Therefore, select this community to observe, and find the problems of public space and the user demand behind the problem, and put forward the corresponding design strategy.

3.1. Space division
In this study, public space is mainly divided into:
- Traffic space. It mainly includes motorway, bicycle lane, sidewalk, parking lot, etc.
- Public service space. This paper mainly studies the space places which are closely related to residents' public service, including commercial service, community service and administrative management.
- Outdoor leisure space. Outdoor leisure space is mainly the outdoor communication space such as leisure square and garden in the community.
- Green space. Green space is one of the main places for residents' activities, which is divided into landscape green space and active green space.
- Boundary space. The boundary space of the community mainly refers to the buildings in the community or the surrounding walls of the buildings, which is a transitional space connecting the public space of the community and the urban space.

3.2. Demand analysis
First of all, we should observe the user behavior when we study the user demand, because the user behavior is hidden behind the user's motivation. Different motivation will lead to different behavior, and the more essential significance of interpreting user motivation is to mine user's needs. This study adopts two research methods: observation and user interview. In the target community, let yourself immerse in the real environment and observe the objects, so as to collect the most authentic materials.

Through the way of photographing, the real record of various behaviors of community users is to analyze the needs of users behind these behaviors. It can be seen from Figure 1 that the elderly gather in the shade on one side of the road to rest, which reflects the elderly's demand for shade; from Figure 2, it can be seen that community users gather under the road shade to play cards, which reflects the community users' demand for entertainment; from figure 3, it can be seen that the children's Square is hard paved and there is no rest seat around, so parents have to stand waiting aside, this phenomenon reflects the needs of children for safety and parents for waiting. Finally, all the user demand of the five space types are sorted out in the same way.
Guided by Maslow’s hierarchy of needs theory, the fragmented user needs of outdoor leisure space are classified by KJ method, and then the classified needs are integrated again by matrix method, so as to extract the final user demand. It can be seen from Figure 4 that the outdoor leisure space corresponds to 14 user needs. Guided by Maslow’s hierarchy of needs theory, the 14 user needs are integrated into five types of needs by matrix method. They include: domain needs, security needs, comfort needs, convenience needs, social interaction needs.

- **Domain requirements.** In a large space of community public space, it is necessary to plan out different spaces of different natures to meet different needs of different behaviors of community users.

- **Security requirements.** It is the most fundamental need of mankind. Community public space should provide all kinds of security equipment, security transportation and security system to protect community users.

- **Comfort requirements.** Comfort demand does not exist independently as other needs, it is a higher requirement for many grass-roots needs. In outdoor leisure space, it is mainly reflected in "cool demand", "waiting demand" and "physiological health demand".

- **Convenience needs.** Many types of space are related to the needs of convenience. In the planning and design of community public space, we should consider how to be used by people conveniently. In outdoor leisure space, it is manifested in "oriented demand" and "barrier-free demand".

- **Social interaction needs.** The main way of life of human beings is to live in groups, and people need to communicate with each other, which is mainly manifested in the outdoor leisure space of the community, which is a need of social communication. Community users need to communicate with neighbors or friends constantly. Friendly space design can promote good communication between community users[4].

**Figure 1.** The main entrance

**Figure 2.** The traffic space

**Figure 3.** The children’s playground

**Figure 4.** Analysis chart of user demand selection
The requirements of the remaining four spaces are sorted out in the same way, and finally a user demand project table is drawn (see Table 1). According to the user demand item table, Kano questionnaire is made, and the questionnaire results are one-to-one corresponding with Kano attribute classification table, so as to obtain the Kano attribute of each requirement and establish the hierarchy model of demand. On the basis of user demand hierarchy model, supplemented by intelligent means, reintegrate the service content of traditional community public space, so as to maximize the satisfaction of community users[5].

Table 1. User demand list of outdoor leisure space

| Demand classification | Domain requirements | Security requirements | Comfort requirements | Convenience requirements | Social communication needs |
|-----------------------|---------------------|----------------------|--------------------|-------------------------|--------------------------|
| **Outdoor leisure space** | Rest needs | Lighting demand | Waiting for demand | Guide demand | Talking needs |
| | Sports demand | Privacy needs | Enjoy the cool demand | Accessibility needs | |
| | Fitness needs | Pavement demand | Health needs | | |
| | Entertainment needs | Partition needs | | | |

3.3. Design strategy of public space in intelligent community

3.3.1. The content of public space is oriented by the needs of community users and effectively realizes the balance of supply and demand. Through big data, Kano questionnaire survey and other tools, the user needs of smart communities are deeply explored and analyzed free of charge, including necessary needs, expected needs, attractive needs and other demand levels, as well as demand preferences and demand changes, etc., Scientifically perceive the real needs of community residents, and provide corresponding accurate services to ensure that the reasonable needs of most community users are met. At the same time, the technical service and tracking management should be realized for the services provided, so that the community residents can use the new products smoothly and evaluate them. Finally, through the data management of the background, the effect of the service products is evaluated to ensure timely correction of product defects and make up for the deficiencies of products.

3.3.2. Enrich the functional layout of public space and improve the regional and humanistic characteristics of the space. The demand of community users is the core point of public space planning of smart community, and the improvement of life quality is the key point to improve the satisfaction of community users. Therefore, in the space planning of smart community public space, we should achieve the goal of complete functions, reasonable zoning and orderly space. Different partitions correspond to different user needs, which greatly meet the needs of community users, so as to improve the satisfaction of community residents. In the construction of public space, we should highlight the local cultural characteristics, break the pattern of "one side of thousands of cities", and plan the space types with local cultural characteristics. The space design should focus on the humanized design concept, realize the sharing of public space, and provide field convenience for the communication of community residents.

3.3.3. The effective integration of Internet of things and information platform enhances the operation and promotion of information platform. Under the background of information technology, the life of community residents directly connects with mobile devices, but user information belongs to different fields, which will not only cause information barriers, but also increase the burden of users. This forces the relevant departments to break the barriers and develop an interconnected and shared community service platform to scientifically increase the content of community services according to the needs of users, so as to meet the needs of community residents to keep pace with the times. In addition, it is more important to strengthen the promotion of service platform, especially to focus on the elderly, the disabled
and other vulnerable groups. It is necessary to provide guidance and popular science services to help these people use the community service platform correctly and let them feel the convenience brought by information technology[6].

4. Conclusion
As an important part of the community, community public space has been unable to meet the needs of community users' material life and spiritual culture at this stage. With the maturity of smart community, the public service provided by smart community in China has gradually changed from "supply oriented" mode to "demand-oriented" mode. More systematic, intelligent and humanized public space design will become a new direction of future development.

On the basis of analyzing the existing problems of community public space, this study, through investigation and analysis, obtains the user needs reflected by the various chaos in the community. After that, we plan to carry out the Kano questionnaire survey on the user demand of the public space in intelligent community. According to the Kano attribute classification table, we can get the Kano attribute of the demand item in each space, and then establish the demand hierarchy model. Nowadays, in the planning and design of public space in smart communities, we should focus on attractive demand and expected demand, which is also the next work to be carried out and completed in this study.

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