Research on the Practical Pathways of Enabling Community Smart Construction through Automation Technology

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Abstract: With the rapid development of information technology and the continuous improvement of urbanization levels, communities, as the basic units of urban governance, have witnessed the implementation of intelligent construction, which has become an important means to enhance urban governance capabilities. Automation technology serves as the driving force for the construction of smart communities, providing new solutions for community management, services, and governance. This paper mainly explores the application value of automation technology in the intelligent construction of communities, analyzes the problems such as technological application disconnection, unbalanced facility construction, and low resident participation in community intelligent construction. From the perspectives of demand-oriented system integration, low-cost sustainable construction models, and resident participation-based service promotion, it explores the practical paths of enabling community intelligent construction through automation technology, providing theoretical references and practical guidance for the modernization of community governance, improvement of residents' living quality, and sustainable development of communities.

Keywords: Automation technology; Smart community; Community governance; Practical approach; Digital transformation

1. Introduction

Under the backdrop of the Digital China strategy and the creation of new-type smart cities, communities, as the link between the government and residents, have undergone a transformation towards intelligence, which has become an important aspect of the high-quality development of cities. Due to the characteristics of automation technology, such as efficiency, accuracy, and intelligence, it provides technical support for the transformation of traditional community management models. After the deep integration of technologies such as the Internet of Things, artificial intelligence, and big data, communities have shifted from passive management to active services, and from extensive governance to meticulous governance. However, there are still issues such as a mismatch between technology and demands, uneven resource allocation, and low acceptance by residents in the process of community intelligentization construction. Therefore, in-depth exploration of the practical approaches that automation technology can contribute to the creation of

community intelligence is of great theoretical and practical significance for solving community governance problems, enhancing residents' sense of gain, and promoting the modernization of communities.

2. The significance of automated technology in enabling smart community construction
2.1. Enhance the efficiency and service level of community management

After the application of automation technology, it will significantly enhance the operational efficiency of the community management process, thereby comprehensively improving the overall management efficiency of the community. The establishment of an intelligent management platform enables the community to collect and dynamically update real-time information data, such as personnel information, facility conditions, and event handling, completely reversing the numerous drawbacks caused by the lag and dispersion of information under the manual management method. The automation system can monitor the community operation 24/7 and promptly detect and warn of various management issues, enabling community staff to respond promptly and adopt the correct handling methods. Automation technology can standardize and regulate the service process, thereby reducing the service differences caused by human factors, ensuring that all residents can obtain the same public services. With the support of data analysis and intelligent decision-making, community managers can rationally allocate resources, change the service structure, and achieve the best results with limited resources, thereby improving service quality [1].

2.2. Improving the convenience and security of residents' lives

The in-depth application of automation technology provides residents with all-around convenience and security. From the perspective of convenience in daily life, the application of automated facilities such as intelligent access control, non-contact passage, online payment, and intelligent express delivery cabinets has significantly reduced the time and complexity of various affairs in residents' daily lives, making community life more convenient and efficient. Automated safety facilities such as intelligent monitoring systems, automatic fire alarm devices, and elevator safety monitoring equipment can achieve real-time perception of community safety status and intelligent early warning, effectively preventing various safety hazards. Special groups such as elderly people living alone and people with disabilities can rely on intelligent wearable devices and emergency call systems to promptly receive safety care and emergency assistance. The intelligent service system created by automation technology not only improves the quality of residents' lives but also strengthens their sense of security and belonging, laying a solid foundation for the construction of a harmonious community [2].

2.3. Promoting the modernization and sustainable development of community governance

Automation technology has endowed the community governance model with powerful forces for innovation and long-term development. In terms of governance modernization, the use of intelligent community platforms with automation can achieve collaborative governance among multiple entities, such as the government, community organizations, property enterprises, and residents, breaking the traditional one-way management model and creating an open and interactive governance ecosystem. After data sharing and intelligent analysis, each governance entity will have a more accurate grasp of residents' needs, a more accurate identification of community problems, and a more objective assessment of governance effects, thereby making governance decisions more scientific and democratic. From the perspective of sustainable development, automation technology can promote the rational allocation and efficient utilization of resources in communities, using intelligent energy management, intelligent waste sorting, and intelligent parking scheduling, and other means to reduce community operating expenses and curb waste. At the same time, the large amount of data accumulated by the automation system provides strong support for community long-term planning, enabling community construction to better adapt to changes in population structure, meet development needs, and promote the long-term healthy development of the community [3].

3. Problems existing in the smartization construction of communities

3.1. The application of automation technology is disconnected from the actual needs of the community

At present, there is a mismatch between the application of technologies and the actual needs in the community's intelligentization construction. The main manifestations are blind technology introduction and functional design that is divorced from reality. In some communities, when promoting intelligentization construction, they overly focus on the advanced nature of technology and the comprehensiveness of the system, while neglecting the characteristics of the community itself and the actual needs of residents, resulting in the intelligent systems that have been invested a large amount of funds having very low actual utilization rates, and even becoming mere decorations. Some automated facilities have complex and cumbersome functional designs that do not conform to the usage habits of the elderly, and instead cause additional burdens for residents. At the same time, different communities have significant differences in population structure, spatial layout, and development levels, etc., but the technical solutions generally use uniform standards and lack targeted customized designs, causing the application of technologies not to truly solve the core problems of the community. The integration of technology applications with the management and service process of the community lacks depth. The automated systems mostly operate independently and do not integrate well into the daily management work of the community, resulting in the failure to fully exert the value of the technology, waste of resources, and low construction efficiency [4]. In addition, some communities fail to conduct adequate preliminary research and scientific demonstration in technology selection, opting for popular technologies merely based on their subjective judgments or following trends, which leads to a serious mismatch between technology and actual scenarios. In the construction of intelligent projects, there is a lack of mechanisms for soliciting and feeding back residents' opinions, making it difficult for their real needs to be effectively conveyed to the technical design stage.

3.2. Inequity in the construction of intelligent facilities and high maintenance costs

The intelligentization construction of communities varies greatly among different regions and types of communities, and there is also the problem of high maintenance costs. From the perspective of construction, newly built communities and those in economically developed areas have sufficient financial support to configure complete intelligent facilities, while old communities and those in economically underdeveloped areas lag significantly in intelligentization construction due to insufficient funds and incomplete infrastructure. This results in a significant difference in the intelligent services enjoyed by residents in different communities. In terms of maintenance, the operation of automated equipment and systems requires continuous investment of funds and professionals to ensure their normal operation, including equipment renewal, system upgrade and optimization, and fault repair and handling. The maintenance costs are often higher than what the communities can bear. After many communities complete their initial construction, due to the lack of stable funding sources for operation and professional technical teams, intelligent facilities gradually age and fail, system functions continuously deteriorate, and they eventually fall into the predicament of "building but not managing, managing but not well", seriously affecting the sustainability of intelligent community construction and the user experience of residents [5]. The single source of construction funds also increases the degree of imbalance. Most communities rely excessively on government financial investment, lacking the involvement of social capital and market-oriented operations. Some communities only focus on technology and neglect planning, prioritize construction over management, and do not consider how to operate after the construction is completed.

3.3. Insufficient digital literacy among residents and low participation levels

The digital literacy level and participation willingness of residents determine the effectiveness of the construction of community intelligence. However, at present, there are problems such as insufficient digital capabilities of residents and low participation levels. On one hand, community residents, especially the elderly, have insufficient understanding of intelligent devices and digital services, and have poor operational skills. When facing complex intelligent systems, they often have no idea where to start, develop a sense of difficulty and resistance, and cannot truly integrate into the life of

the smart community. Due to various reasons, such as busy work and a lack of interest among young residents, they do not attach much importance to the construction of community intelligence and have a weak willingness to participate. Additionally, during the process of promoting intelligence in the community, no effective publicity guidance and training mechanisms have been established. Residents are unclear about the functional value and usage methods of intelligent devices, which leads to low usage rates and poor recognition of intelligent services. Some smart community platforms lack interactivity and entertainment value, and cannot effectively motivate residents to participate actively. Residents are more in a passive state of receiving services, lacking the motivation to actively participate in community governance and construction, making it difficult for the construction of smart communities to form a good situation of joint construction, governance, and sharing by the government, community, and residents. The digital gap is becoming more and more obvious among different groups. People with low education and income face more prominent digital application problems and are more likely to feel marginalized by the smart community. The community lacks a continuous digital training system, and the occasional training activities are merely formalities. The training content is disconnected from practical application and cannot truly improve residents' digital capabilities.

4. Practical approaches for enabling community smart development through automation technology
4.1. Demand-oriented intelligent system integration and deployment
The intelligent system established based on the residents' needs is the first element endowed with automation technology. The community should establish a mechanism for systematic needs research, through methods such as questionnaires, symposiums, and data analysis, to comprehensively and deeply understand the true needs and pain points of residents of different age groups and living conditions, and then form a detailed list of needs and prioritize them. On this basis, scientifically plan out the functional modules and technical solutions of the intelligent system, ensuring that the application of each technology can solve practical problems and create practical value. During the system integration, consider technical applicability and compatibility, select convenient-to-operate and stable, reliable technical solutions, and not pursue advancement at the expense of reality. Based on the personalized factors such as the community's spatial characteristics, population structure, and cultural traditions, implement a differentiated system configuration and customized function development for the community, so that the application of technology is in line with the actual situation of the community. In the deployment and implementation stage, adopt a step-by-step advancement and gradual improvement approach, first build the core functions that residents urgently need, continuously improve based on usage feedback, and avoid the waste of resources due to a large-scale construction approach. Also, establish a dynamic evaluation mechanism for technology application, regularly collect residents' opinions, promptly adjust and improve the system's functions, ensure that the intelligent system can always meet the actual needs of residents, truly achieve the goal of technology serving people, and enhance residents' sense of gain and happiness. In addition, create a cross-departmental collaboration mechanism, integrate data resources from various aspects such as civil affairs, public security, and health, break through the constraints of information islands, achieve data interconnection and intercommunication, as well as business collaborative processing. The intelligent system deeply integrates with the city brain and the government service platform to improve the intelligence level of community governance, increase data security and privacy protection efforts, improve the regulations and systems for data collection, storage, and use, and ensure the security of residents' personal information. Create emergency plans and backup systems to prevent risks of service interruption caused by system failures, and ensure the stable operation and continuous service of the community.

4.2. Low-cost and sustainable smart facility construction model
To solve the problems of insufficient funds and maintenance difficulties, it is necessary to innovate the construction and operation models of intelligent facilities, integrating low-cost investment with sustainable operation. In terms of construction methods, the principle of putting practicality first and acting within one's means should be adhered to. The construction standards and scale should be determined based on the actual situation and economic level of the

community to prevent excessive financial pressure beyond its capacity. Choose automated equipment and systems with high cost-effectiveness, mature technology, and convenient maintenance. Use appropriate technology rather than the most advanced technology to meet basic service needs. For old communities, the existing facilities can be fully utilized. Through local renovations and functional upgrades, the work of smart transformation can be completed, thereby reducing the overall construction cost. In terms of fundraising, diversified investment and financing mechanisms should be explored. In addition to government fiscal investment, social capital can also be attracted to participate in the construction of community smartization. Cooperation between the government and enterprises, public-private partnerships, etc., can be adopted to share the construction pressure. A commercial operation model can be explored where the operation enterprise undertakes the construction and maintenance costs and gains revenue by providing value-added services. An effective long-term operation mechanism and sustainable financial guarantee system should be established. Special funds for community smart operation can be set up, and professional operation service teams can be introduced to ensure the normal operation and timely maintenance of facilities and equipment. A modular and standardized technical architecture can facilitate equipment replacement, upgrade, and system expansion optimization, reducing long-term operation costs. Strengthen technical training for community staff to enhance their basic operation capabilities and reduce reliance on external technical support, forming a reasonable investment, stable operation, and sustainable development model for smart community construction. Explore regional collaboration and resource-sharing models, using joint procurement and shared construction by multiple communities to reduce the construction cost of a single community. Promote the use of open-source technologies and domestic equipment, reduce reliance on imported high-end equipment, and lower technical costs and maintenance expenses. Establish a full life cycle management system for facilities and equipment, manage equipment ledgers, maintenance records, and update plans, etc., to improve the efficiency and service life of the equipment. Encourage research institutions and universities to collaborate with communities, adopt technological research and pilot application methods to obtain technical support, and reduce the cost of technology introduction.

4.3. Resident participation-based digital service promotion mechanism

Improving residents' digital literacy and participation is the key to the success of smart community construction. A comprehensive and multi-level participatory promotion system must be established. In terms of publicity and guidance, various channels such as community notice boards, residents' WeChat groups, and offline activities should be fully utilized to widely disseminate the significance of smart community construction and the convenience of intelligent services. Through vivid and vivid displays and sharing of real cases, the residents' sense of recognition and anticipation for intelligent construction can be enhanced. In terms of capacity training, differentiated and stratified digital skills training should be provided for different groups, especially elderly residents, using various forms such as one-on-one guidance, group teaching, and practical exercises for training. Residents can master the methods of using intelligent devices and the operation procedures of digital services. Young residents can be recruited as volunteers to provide digital assistance among neighbors, enabling more residents to cross the digital divide and enjoy an intelligent life. The platform design should take into account the usage habits and ability levels of different groups, optimize the interface design and operation procedures, add humanized functions such as voice interaction, large font display, and one-click operation, and lower the usage threshold to improve the usage experience. From the perspective of participation incentives, innovative resident participation mechanisms should be adopted, such as through points rewards, honorary recognition, and service feedback, to mobilize the enthusiasm of residents to participate in the construction and governance of community smartization. Establish interactive modules such as resident consultation platforms, demand collection channels, and satisfaction evaluation systems, allowing residents to express their demands, participate in decision-making, supervise services, and become the creators and beneficiaries of smart communities. Through continuous education and guidance and mechanism innovation, gradually cultivate residents' digital living habits and community participation awareness, creating a favorable atmosphere for all citizens to jointly build and share smart communities. Establish a regular service experience feedback mechanism, hold resident experience activities, and conduct resident satisfaction surveys regularly to promptly identify and

solve problems in the usage process. Cultivate a community digital culture by holding activities such as smart life festivals and digital skills competitions to create a favorable atmosphere for the use of intelligent services. Establish a hierarchical service system, while promoting digital services, retaining traditional service channels to ensure that residents who cannot use intelligent devices can also obtain basic services. Strengthen collaboration with schools and enterprises, carry out digital literacy education in communities, and improve the digital capabilities and information literacy of residents of all age groups.

5. Conclusion

Automation technology provides strong technical support and broad development space for the intelligent construction of communities. However, the technology itself is not the goal. The key to truly realizing the empowerment of technology lies in identifying needs, optimizing models, and reaching consensus. After creating an intelligent system with a demand-oriented approach, exploring cost-effective and sustainable creation methods, and establishing a resident participation-based implementation mechanism, it is possible to effectively overcome the actual difficulties encountered in the current intelligent construction of communities, promoting the deep integration of automation technology with community governance. As technology continues to develop, the role of community intelligent construction in improving management efficiency, improving people's living conditions, and promoting social harmony and development will become increasingly prominent, contributing to the construction of a better intelligent society.

Funding

Disclosure statement

The author declares no conflict of interest.

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