Hindawi
Mobile Information Systems
Volume 2022, Article ID 3179358, 9 pages
https://doi.org/10.1155/2022/3179358

Research Article

Multifactors Affecting Residential Well-Being in Urban Communities of Shenzhen Incorporating Intelligent Technologies

Xintong Wei,[1,2] **Guangtian Zou**,[1] **and Kin Wai Michael Siu**[2]

[1]*School of Architecture, Harbin Institute of Technology, Key Laboratory of Cold Region Urban and Rural Human Settlement Environment Science and Technology, Ministry of Industry and Information Technology, Harbin 150006, China*
[2]*School of Design and RISUD, The Hong Kong Polytechnic University, Hong Kong 999077, China*

Correspondence should be addressed to Guangtian Zou; zougt@hit.edu.cn

Received 7 June 2022; Accepted 2 July 2022; Published 30 July 2022

Academic Editor: Xingsi Xue

Rapid urban development is inseparable from technological advances, and the application of artificial intelligence in community life is becoming widespread, affecting residents' lifestyles and psychological well-being. This study investigated a variety of factors that affect the well-being of urban community residents. Environmental and emotional perceptions and overall well-being were assessed based on the responses of 179 respondents from six small communities in Shenzhen, China. Property management was strongly correlated with satisfaction with the physical environment and least correlated with neighborhood form. Pleasure, comfort, and the sense of belonging were correlated. In addition, interviews and questionnaires revealed a strong influence of AI facilities on people's well-being. Factor analysis revealed two-component matrices that explained more than 60% of the factors, which were described as "external" and "internal" factors. Finally, the study analyzes the relationship between intelligent devices and impact factors and their effects on residential well-being.

1. Introduction

1.1. Background. Since China's economic reform in 1978, the country has been developing at a rapid pace and various new technologies have been gradually applied in various industries. Urbanization has led to a significant increase in the number of people living in crowded spaces and illegal or informal settlements [1], creating a range of problems for people's lives and the environment [2]. At the same time, the application of artificial intelligence technologies in the building sector has contributed to the rapid development of smart buildings that optimize energy consumption and perform automatic adjustments while maximizing user comfort and satisfaction, and to some extent, the public health of residents [3]. Intelligent devices can greatly improve the efficiency of work through the effective integration of intelligent technology and the basic functions of the device, relying on the advantages of emerging technologies, and intelligent devices have been integrated into all aspects of people's lives. In urban communities, the use of intelligent access control systems, intelligent parking projects, intelligent homes, and intelligent alarm systems provides a diversity of intelligent services for people's lives.

There has been considerable evidence showing that people living in urban spaces in densely populated cities experience increased rates of stress and depression, and the living environment plays an important role in such situations. According to a report by WHO [4], an estimated 4.4% of the global population suffers from depressive disorder and 3.6% from anxiety disorder. In the context of high-density urban living, scholars have begun to study the importance of the environment in the improvement of urban living quality, psychological health, and well-being of urban residents [5, 6]. Well-being, which is related to the subjective feelings of individuals, is a complex concept in the field of psychology; SWB is a classical term that is widely researched. After SWB was first mentioned in the 1950s, its meaning was eventually described as a preponderance of positive over

negative affect [7]. From a subjective perspective, Andrews and Withey [8] found that most people consider SWB as an assessment of quality of life related to life satisfaction. With the development of research, Diener [9] proposed that SWB is a comprehensive judgement of individuals regarding their overall quality of life based on self-determined standards, referring to people's cognitive and affective evaluations of their own lives. He also stated that well-being is influenced by components of SWB, such as satisfaction with important domains, life satisfaction, low levels of negative affect, and high levels of positive affect [10]. This theory is also the theoretical support for the concept of "residential well-being" used in this study. However, most of the existing studies on well-being have been conducted from economic, cultural, social, and environmental aspects, and few scholars have considered the impact of intelligent devices on well-being. Based on these concepts and backgrounds, this study aims to explore the factors influencing residential well-being in urban communities in the context of the rapid development of smart technologies.

2. Potential Multifactors Affecting Residential Well-Being

To reach a deeper understanding of residential well-being, we reviewed the literature containing concepts relevant to our topic. As shown in Figure 1, mental or psychological well-being is influenced not only by individual characteristics or attributes but also by the socioeconomic circumstances in which people find themselves and the broader environment in which they live. Experts on emotions might argue that people's emotions, both positive and negative, evolved to help people assess their emotional state, and are therefore all equally desirable in appropriate circumstances; well-being experts assume that positive emotions are desirable and negative emotions are undesirable [9]. In this study, we consider residential well-being as a positive concept, as we focus on improving the urban living environment. The basic premise of this study is that residential well-being is a comprehensive concept, including the positive affect of residents and satisfaction with aspects of the environment.

Positive affect is defined as feelings and emotions that reflect a level of pleasurable engagement with the environment, such as happiness, joy, excitement, and contentment [11]. Emotions are a part of being human and are defined as psychological states brought about by subjective feelings [12]. In addition, there is some evidence that positive affect can facilitate behaviors reflecting a positive "approach" instead of social withdrawal [13]. From this perspective, experiences of positive affect could promote an individual's engagement with the built environment, which significantly impacts residential well-being. Additionally, some evidence suggests that people can improve their emotional well-being by cultivating experiences of positive emotions [14].

Given this background, in this study, we aim to assess the residential well-being in urban communities in Shenzhen, China. We used a questionnaire to evaluate residents' environmental and emotional perceptions, as well as overall

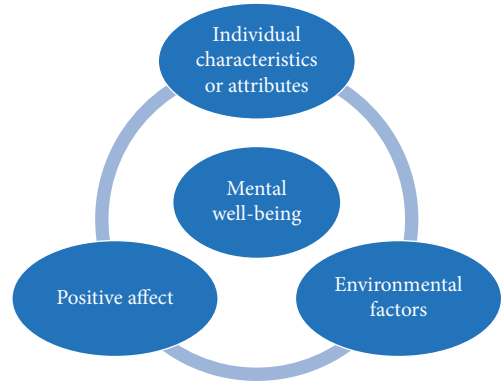

Figure 1: Multifactors of mental well-being.

residential well-being. By screening positive emotions related to the living environment, we finally summarized five emotions in the questionnaire, including the feelings of belonging, pleasure, security, convenience, and comfort. The five emotions reflect residents' positive affect, including engagement and positive emotions, assessed through self-report.

Regarding the environmental aspects, we collected residents' satisfaction with various elements in the living environment. According to reports from the WHO in 2018, neighborhood forms, housing quality, access to utilities and transport services, public green spaces, street safety, and social cohesion related to various aspects of the urban community may affect mental health to different degrees [15]. Additionally, many studies have suggested that some elements of the living environment can affect people's mental health or well-being, but these studies only focused on a specific aspect, which cannot cover most factors of the living environment. For example, neighborhood aesthetic quality and quantity of green spaces in living environments were demonstrated by a few studies to have positive associations with higher mental well-being [16, 17]; some other studies investigated the effects of changing the quality of housing on mental health and well-being in adults and the elderly individuals [18, 19]. Furthermore, Pollock et al. [20] proposed that the interaction between physical and mental health and changes in living environment, such as the distance from residence to public transportation or surrounding facilities, can be considered to affect mental health indirectly. Weinhardt et al. [21] explored that the experiences of public facility use are related to psychological well-being. According to the problems found in the field survey of the selected community and the face-to-face interviews with property management staff and residents, it can be known that property management has a great impact on residents' well-being, such as management of garbage classification and planning of parking spaces in the community. In this context, we summarize six elements, namely, "green space" and "neighborhood form" drawn from Bond and Gong [16, 17], "accessibility of transportation" drawn from Pollock [20], "public facilities in the community" drawn from Weinhardt [21], "property management" drawn from the

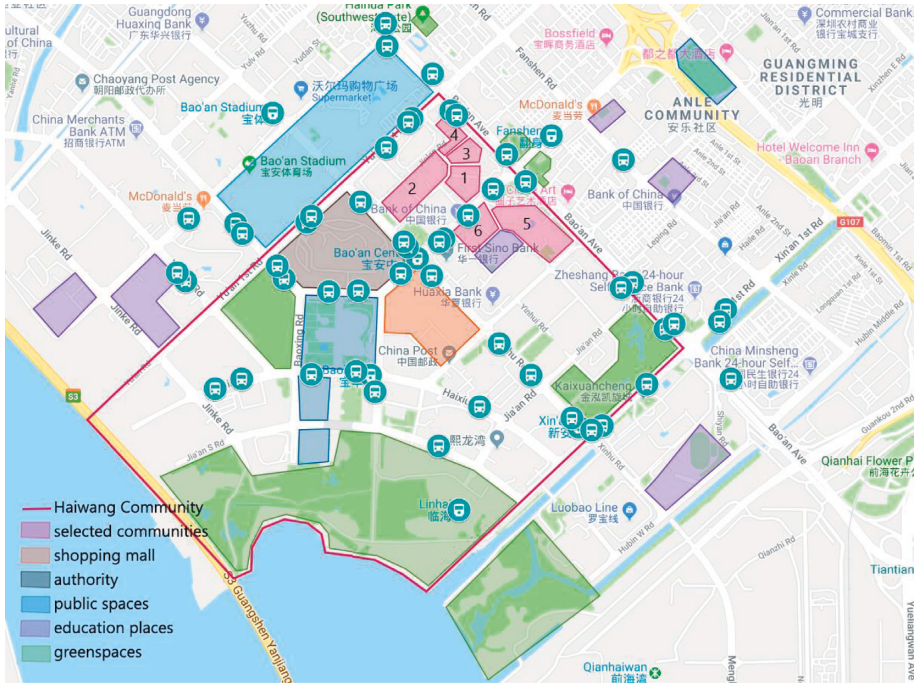

Figure 2: An overview of selected communities in Shenzhen.

findings of interviews, and "quality of housing" drawn from Rafaely and Tao [18, 19]. Instead of focusing on a single factor of the living environment, this study explored multiple environmental factors influencing residential well-being, especially emotional factors in relation to the psychological aspects. Therefore, this study proposes a hypothesis that six environmental factors and five affective factors all have an impact on residential well-being.

3. Methods

3.1. Selection of Study Location. To justify the above combination of factors, we selected several small communities in Shenzhen for our practical study. First, we chose Shenzhen (a densely populated city in China) as our target city because it has witnessed some of the most rapid and advanced infrastructure developments in recent years. In Shenzhen, AI technology is widely used in neighborhood construction, and there are many new small residential neighborhoods. By studying them, we hope to determine the human impact of the community environment under AI applications and explore ways to improve the process of continuous urbanization. Of the many small-scale residential communities in Shenzhen, Haiwang Community was an ideal candidate for our research. Haiwang Community (Figure 2) has a short history. It was built in 2004 and the construction of the community progressed very quickly. Since 2004, 11 high-rise commercial and residential communities have been built successively, most of which met our selection requirements, as detailed below.

First, the communities had a relatively organized property management system, which excluded some older small-scale communities. Second, the selection had a clear distinction between the internal and external areas of the community, to ensure that the study's subjects would understand the questions related to regional divisions in the questionnaire. Third, to avoid the influence of uncontrollable factors such as community culture and geographical location, we chose different small-scale communities in the same community to conduct the practical study. Fourth, we considered that the price of housing imposes certain restrictions on residents' personal economic conditions and some other related factors, such as social status and quality of life. Therefore, the price of housing within the selected residential areas was within a certain range (based on average house prices in Shenzhen) to ensure that the research results would be widely applicable.

Based on the above considerations, we chose six small-scale communities within Haiwang Community in the Baoan District of Shenzhen, which were coded as communities 1–6 (Figure 2) owing to ethical and privacy issues. Figure 2 shows an overview of the selected small-scale communities and their surroundings. There are 6 subway stations and more than 30 bus stops inside Haiwang Community and more than 10 other bus stops around the community. Additionally, there are many green spaces and public spaces inside and around the Haiwang Community, and a big shopping mall is located near the selected small-scale communities. Outside Haiwang Community, there are some sports clubs and Boan Stadium, which are only a 15-minute walk from the selected small-scale communities.

3.2. Questionnaire Design. As the purpose of this study was to enable residents to report what made them feel good about their living environment, instead of letting researchers define residential well-being for them, a questionnaire was considered the most effective and efficient way of capturing

individuals' experience of residential well-being [22]. In addition, although self-reporting of global SWB and life satisfaction might be influenced to some extent by transient factors, a considerable number of evidence shows that SWB is a stable state, and measures of it show considerable temporal reliability [23]. All questions about satisfaction levels and feelings about the living environment in the first section of the questionnaire were closed-ended questions because they are easier for respondents to answer and can reduce the number of irrelevant or confusing answers as well [24].

The questionnaire covered four aspects of self-assessment: basic information, overall residential well-being, satisfaction with environmental factors, and perceptions of different emotions. This study aimed to reveal the multifactors of residential well-being in urban communities. However, when people were asked about a particular emotion or environmental aspect, they would answer the first thing that came to mind and neglect, why they answered in that specific way and whether it was accurate. To avoid preconceived impressions, respondents were first asked about their overall residential well-being instead of their perception of a single factor. To investigate the relationship between residential well-being and environmental aspects, respondents were required to assess their level of satisfaction in relation to different environmental factors.

Considering the perception of emotions, when people were directly asked about a specific emotion, they might have had a different understanding of its meaning, which could have affected the validity of the research results to some extent. Therefore, to avoid misunderstandings, respondents were asked to evaluate the degree of their agreement with different descriptions, instead of rating the intensity of their emotions. At the end of the questionnaire, respondents were asked to rate their expected well-being considering the smart devices they were currently using and assuming that multiple smart devices would be introduced into their residential community in the future.

Respondents' answers were evaluated on a 5-point Likert-type scale. They were asked to rate the following aspects:

Overall residential well-being, from 1 (lowest) to 5 (highest).

Six items regarding environmental satisfaction (green space, neighborhood form, public transport, open space design, property management, and housing quality), from 1 (totally dissatisfied) to 5 (totally satisfied).

Five statements about emotions ("I feel that it is very convenient to travel and live here," "The layout and facilities here make me feel comfortable," "The management here makes me feel safe," and "Living here I feel a part of the community," and "The public environment and architectural appearance in the community make me feel happy"), from 1 (totally disagree) to 5 (totally agree).

3.3. Data Collection. The following approaches were applied in this study to collect data. The first approach was to set up an online questionnaire and send it to residents' online contact groups, which was convenient for the respondents. To ensure the authenticity of the collected data, we included a question in the online questionnaire for screening unqualified respondents who did not live in the selected communities. In addition, the online questionnaire had a submission limit so that each account could submit the questionnaire only once. The second approach was to randomly distribute questionnaires in-person, on weekday evenings in the public areas of the community, which was more efficient for the researchers. Moreover, the questionnaires were distributed randomly on different floors of each building to improve the validity of the study. In the adoption of these two approaches, we collected 201 questionnaires. Following this, we screened the questionnaires, excluding those that were not answered completely or had obvious problems. After the screening, there were 179 valid questionnaires left.

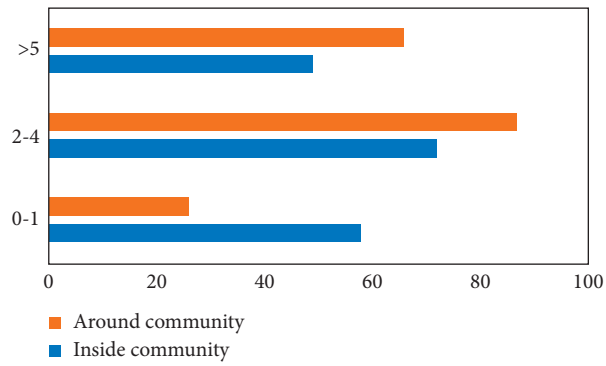

Figure 3: Frequency of use of exercise spaces inside and around the community.

Table 1: Residential well-being level of five communities.

	N	Mean	Minimum	Maximum
Community 1	43	3.40	1	5
Community 2	28	3.79	3	5
Community 3	32	3.56	2	5
Community 4	37	3.51	2	5
Community 6	30	4.00	1	5
Total	170	3.62	1	5

3.4. Data Analysis. SPSS 21.0 was used to establish a database containing all results of both online and on-site questionnaires, including multifactors [12]. The data were analyzed using the following methods: a statistical analysis to understand the basic data of respondents, a correlational analysis to calculate the relationships between different factors and residential well-being, and the factor analysis of emotional and environmental responses to extract factors that could summarize the results of the residential well-being questionnaire.

4. Results and Analysis

4.1. Statistical Analysis of Field Data. The gender balance of the respondents was 43% men and 57% women. The

Table 2: Correlations between environmental satisfaction and residential well-being.

		Green space satisfaction	Neighborhood form satisfaction	Public transportation satisfaction
Residential well-being	Correlation	0.582	0.332	0.377
	Significance (2-tailed)	0.000	0.000	0.000
		Open space design satisfaction	Property management satisfaction	Housing quality satisfaction
	Correlation	0.599	0.620	0.553
	Significance (2-tailed)	0.000	0.000	0.000

education level of the respondents was mainly junior college/under graduation, with 76.5% of respondents being undergraduates. Respondents were mainly between 15 and 59 years of age (66.5% were aged 35–59 years and 31.3% were aged 15–34 years). In terms of family structure, 90.5% of respondents lived with direct relatives, while 5.6% of respondents lived on their own. With respect to the distribution of respondents based on the duration of their stay in the community, the number of residents who lived there for more than 5 years was the highest, accounting for 63.7%, and the number of respondents who lived between 1–5 years accounted for 23.5%.

In addition, we interviewed the respondents about the frequency of their use of exercise spaces inside and around the community to understand more about their daily lives. As shown in Figure 3, 67.6% of respondents often exercised (2–4, 5, or more than 5 times weekly) inside the community public spaces, while 32.4% of respondents rarely exercised inside the community public spaces. Of the total respondents, 85.5% respondents exercised in areas around the community. Overall, the majority of residents living in Haiwang Community like to carry out activities in the living environment, and therefore, we consider that the results of these respondents can reflect the residents' perceptions of the living environment to some extent.

As listed in Table 1, we compared six small-scale communities in the Haiwang Community to ascertain residential well-being based on residents' self-reports. Since the data from community 5 were from less than 30 respondents (because of some uncontrollable reasons), we excluded the respective communities when considering the overall residential well-being in each community. As listed in Table 1, the overall residential well-being in Haiwang Community was 3.62. Although community 6 had the highest overall sense of well-being, the majority of residents living in Community 2 felt a higher sense of residential well-being because no one in Community 2 gave an answer of less than 3 points.

4.2. Correlations between Different Factors and Residential Well-Being. Correlation analysis was performed by combing the data of six small-scale communities, to find the associations between residential well-being and satisfaction with different environmental aspects. Table 2 lists the results of environmental satisfaction and residential well-being levels, with the community as the control variable. All six aspects were significantly positively correlated with residential well-being. While the satisfaction with property management seemed to have the most significant correlation with residential well-being, the satisfaction with green space and open space design also showed significant correlations with residential well-being in the result. Although the neighborhood form showed the weakest association with residential well-being, it still reached a correlation value of 0.332. Public transportation showed the second-lowest significance in the correlation results. It seemed that space design and housing quality had more positive correlations with residential well-being than did public transportation.

Table 3 lists the results of correlation analysis between five emotions and residential well-being based on respondents' self-assessment, with the community as the control variable. The results illustrated that five emotional factors had a significant positive correlation with residential well-being. Among them, the sense of pleasure was the most closely related to residential well-being (reaching 0.661). While the sense of convenience showed the lowest correlation in comparison, however, it was still significantly correlated with residential well-being. In addition, comfort and belonging played essential roles in the results, with correlations of 0.531 and 0.516, respectively. The results showed that positive psychological feelings such as pleasure and comfort showed more significant correlations with residential well-being than practical aspects such as convenience and security.

4.3. Relationship between Emotional Factors and Environmental Satisfaction. We also conducted a correlation analysis between emotional factors and environmental satisfaction to explore the relationship between different aspects of factors and check whether the factors could be interpreted using principal component analysis. As listed in Table 4, each of the six factors of environmental satisfaction was significantly correlated with each of the five emotional factors, respectively, which were suitable for principal component analysis. Green space had a significant correlation with respondents' pleasure level, which was also the highest correlation in the results. Additionally, the pleasure level was clearly correlated with open space design and property management. While public transportation significantly impacted the convenience level (correlation of 0.589), housing quality showed a high correlation with the comfort level (0.537). Although neighborhood form did not have the

Table 3: Correlations between emotional factors and residential well-being.

		Convenience level	Comfort level	Security level	Belonging level	Pleasure level
Residential well-being	Correlation	0.344	0.531	0.461	0.516	0.661
	Significance (2-tailed)	0.000	0.000	0.000	0.000	0.000

Table 4: Relationships between emotional factors and environmental satisfaction.

		Convenience level	Comfort level	Security level	Belonging level	Pleasure level
Green space satisfaction	Correlation	0.291	0.579	0.398	0.542	0.702
	Significance (2-tailed)	0.000	0.000	0.000	0.000	0.000
Neighborhood form satisfaction	Correlation	0.182	0.341	0.255	0.391	0.309
	Significance (2-tailed)	0.015	0.000	0.001	0.000	0.000
Public transportation satisfaction	Correlation	0.589	0.419	0.371	0.423	0.430
	Significance (2-tailed)	0.000	0.000	0.000	0.000	0.000
Open space design satisfaction	Correlation	0.249	0.595	0.388	0.547	0.692
	Significance (2-tailed)	0.001	0.000	0.000	0.000	0.000
Property management satisfaction	Correlation	0.283	0.578	0.386	0.487	0.693
	Significance (2-tailed)	0.000	0.000	0.000	0.000	0.000
Housing quality satisfaction	Correlation	0.431	0.537	0.437	0.517	0.607
	Significance (2-tailed)	0.000	0.000	0.000	0.000	0.000

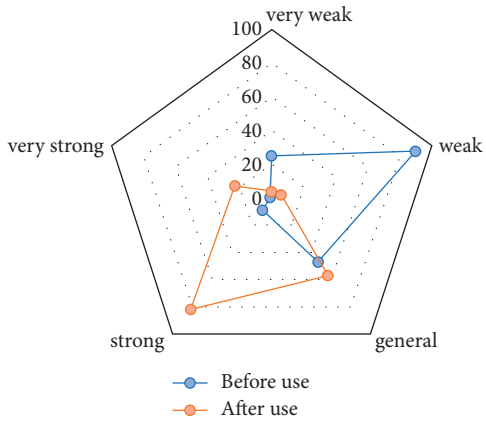

Figure 4: Comparison of the residential well-being before and after using intelligent devices.

strongest association with residential well-being, the results showed a strong correlation between neighborhood form and five emotion levels.

4.4. Comparison of the Residential Well-Being before and after Using Intelligent Devices. As shown in Figure 4, we compared the two data from the questionnaire on overall living satisfaction. The results show that when people consider the use of intelligent devices or think about the integration of intelligent devices into their lives in the future, there is an overall upward trend in their residential well-being. A significant increase in the frequency of strong and very strong residential well-being can be found with the use of smart devices. This reveals that the introduction of intelligent devices can compensate to a certain extent for the negative impact of other environmental factors on residents and indicates that residents' acceptance of intelligent devices is positive and eager.

Table 5: Rotated component matrixes.

	1	2
Green space satisfaction	0.815	0.184
Neighborhood satisfaction	0.395	0.260
Public transportation satisfaction	0.249	0.785
Open space design satisfaction	0.862	0.128
Management satisfaction	0.827	0.158
Housing quality satisfaction	0.644	0.415
Convenience level	0.098	0.882
Comfort level	0.747	0.292
Security level	0.471	0.509
Belonging level	0.647	0.464
Pleasure level	0.846	0.273

4.5. Factor Analysis of Residential Well-Being. Since there were significant correlations among all factors, we conducted factor analysis to explore the deep relationship and coefficient matrix of different factors. The result of Kaiser–Meyer–Olkin and Bartlett's test was 0.909, which meant the data could be analyzed through factor analysis. Based on the results of the principal component analysis, we selected the top two components to explain 63.56% of the 11 factors. Table 5 lists the results of the rotated component matrixes. Component 2 was strongly correlated with public transportation satisfaction, convenience level, and security level, which were always related to the surrounding conditions and geographical location of the urban communities. Thus, we named Component 2 an "external factor." The other eight factors had strong correlations with Component 1. We summarized Component 1 as "internal factor" for all related factors showing significant correlations with the internal conditions and psychological feelings.

5. Discussions

This study investigated the effects of environmental satisfaction and emotional factors on residential well-being in

urban communities in Shenzhen. A practical field study was carried out by collecting questionnaires and interviewing residents, where respondents evaluated their overall residential well-being, satisfaction with different environmental aspects, and levels of five emotional factors. The three main findings are discussed below.

First, the results showed that residential well-being was significantly associated with six environmental aspects and five emotional responses. Satisfaction with neighborhood and public transportation had the weakest correlation with residential well-being, as reflected by the results of the correlation analysis. This finding corresponded to the result that the feeling of convenience showed the lowest correlation with residential well-being. This suggests that residential well-being had more to do with the psychological situation than with the convenience of transportation. Additionally, the selected small-scale communities in this study were in the same community, so the transportation conditions and convenience levels of the living environment were similar for the respondents. Based on the interviews of some respondents, we were able to understand that when the residents were asked about their sense of residential well-being, they may think more about their feelings toward other factors and neglect the convenience of transportation to some extent. In terms of the neighborhood form, the reason for the low correlation could be the change in lifestyle in modern cities like Shenzhen. When people move to high-rise buildings, they progressively have less communication with their neighbors and might not even know the people who live next door. Interviews revealed that the application of intelligent facilities in neighborhoods allows people to live more efficiently and independently but at the same time reduces the opportunities for neighborhood communication. For example, many new neighborhoods in Shenzhen have applied face recognition technology to the systems of neighborhood gates and unit doors (Figure 5), which enhances the convenience of living in the neighborhood while greatly reducing the socialization and mutual assistance between neighbors. As a result, the alienation of the neighborhood was considered unimportant when respondents evaluated their residential well-being. In other words, the factors related to transportation and neighborhood form showed the least correlation with residential well-being in this study.

We also found that property management was the most strongly associated factor with residential well-being in terms of environmental satisfaction. This finding was not expected before analyzing the data. The reason might be the overall improvement of community construction. When the basic facilities of the living environment were satisfied, people began to pursue better levels of living conditions and factors such as property management and service reflected the quality of the community to some extent. According to the interviews, most respondents mentioned the problems of garbage disposal and sanitation, which were within the scope of property management. Another reason might be the importance placed on garbage sorting in Shenzhen during the time the field study was conducted, as the local authority encouraged recycling. During the time the study was conducted, considerable information about garbage sorting

Figure 5: Face recognition to enter the unit building (taken by the author).

policies was displayed publicly in the community. This context made people more aware of property management and regardless of whether this created a good or bad impression, it might have influenced the results of this study as it was easily recalled when respondents responded to the questionnaire. The above reasons are suggested to demonstrate why property management showed the highest correlation with residential well-being in the results. In addition, open space and green space played an important role in the environmental satisfaction results, which reflects residents' attention to the physical environment. In terms of emotional factors, the results showed that feelings of pleasure and comfort had the highest correlations with residential well-being, followed by feelings of belonging. According to these results, when talking about residential well-being, people considered and cared more about positive perceptions of the living environment such as pleasure, comfort, and belonging than the practical aspects such as whether the environment was safe and convenient. This finding was also consistent with the description of SWB, which is more connected to people's emotions and feelings. In addition, although this study found that the use of intelligent devices can enhance the residential well-being to a certain extent, what in-depth links exist between intelligent devices and the factors influencing residential well-being still need to be further explored.

5.1. Application of Artificial Intelligence in Enhancing Residential Well-Being. Based on the results of factor analysis, we can summarize two main components of the 11 influential factors: external factors and internal factors. External factors included levels of convenience, security, and satisfaction with public transport, which were mainly related to public transport and physical facilities around the community. On the other hand, internal factors included satisfaction with green space, open space, property management, neighborhood form, housing quality, and levels of comfort, belonging, and pleasure. These eight factors were primarily related to the physical environment and management inside the community, and therefore, we called these components internal factors. During the interview process, some residents had strong expectations for the intelligence of the neighborhood, and existing studies have shown the positive impact of an intelligent built environment on human well-being. Therefore, we explore the

Figure 6: Community management cloud platform (taken from Yunmou Community and Xingtianxia Applet).

Figure 7: Infrared alignment detectors (retrieved from http://www.youboy.com/s504637858.html).

possible effective applications of AI technology in enhancing residential well-being.

First, the application of the community management cloud platform (Figure 6) contains the integration of various intelligent technologies such as face recognition, password door opening, and smart door lock. This not only promotes communication efficiency between property and residents and facilitates timely access to community information, but the use of the smart platform also greatly reduces the burden of travel for residents by eliminating the need for traditional key and door cards. In addition, the platform's display of community activities may increase the likelihood of residents' social engagement, thus improving the sense of belonging in the community. In enhancing community security, the diverse applications of infrared sensors help improve the overall alarm system of a neighborhood, as shown in Figure 7. When it is applied to the monitoring system, the alarm signal is connected to the control center through the network, and when an intruder enters the community boundary, an alarm signal is sent. The application of infrared sensor technology helps reduce crime rates and enhance residents' sense of security while facilitating property and security personnel to manage neighborhood security. Infrared sensors can also be applied to electrical equipment and fire prevention, enhancing the quality of housing while safeguarding the lives and property of residents.

Although Shenzhen was selected as a representative sample as a typical city with the rapid urbanization of technology, our focus on Shenzhen only would lead to limitations in the study findings. Therefore, future research should use more diverse data and analysis methods to investigate in depth the mechanisms of built environment influence on residential well-being and what kind of impact artificial intelligence can have in promoting residential well-being, and further develop intelligent built environment factors related to residential well-being. By investigating which environmental factors can positively affect residents' emotions, community environment design strategies to improve well-being can be developed in the future through the adaptation of intelligent technologies to improve the residential well-being of urban communities.

6. Conclusions

This study explores the factors influencing residential well-being and the impact of smart devices in residential communities on well-being. Six environmental factors and five affective factors were found to be significantly associated with residential well-being. Factors related to transportation and neighborhood form have the least association with residential well-being, while property management is the factor most strongly associated with residential well-being. In terms of the emotional factors, pleasure and comfort were most associated with residential well-being. In addition, it was found that the application of intelligent devices can enhance residential well-being, but the specific influence mechanism still needs further study.

Data Availability

The data are available from the first author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

This work was supported by the Harbin Institute of Technology and The Hong Kong Polytechnic University. The research was funded by the National Natural Science Foundation of China (52078158). The authors would also like to acknowledge the support of Eric C. Yim Endowed Professorship in Inclusive Design (8.73.09.847K).

References

[1] World Health Organization, *Our Planet, Our Health: Report of the WHO Commission on Health and Environment*, WHO, Geneva, Switcherland, 1992.

[2] X. J. Yang, "China's rapid urbanization," *Science*, vol. 342, no. 6156, p. 310, 2013.

[3] K. Cui and C. Liu, "Artificial intelligence + elderly services: development model and realization path," *Chinese Journal of Gerontology*, vol. 42, no. 8, pp. 2037–2044, 2022.

[4] World Health Organization, "Depression and other common mental disorders," 2017, https://apps.who.int/iris/bitstream/handle/10665/254610/WHO-MSD-MER-2017.2-eng.pdf.

[5] S.-C. C. Lung, C.-R. Lee, and S.-C. Hu, "Inequality of Asian-type neighborhood environmental quality in communities with different urbanization levels," *Environmental Science & Policy*, vol. 38, pp. 1–10, 2014.

[6] G. Sansom, J. Parras, A. Parras et al., "The impacts of exposure to environmental risk on physical and mental health in a small geographic community in Houston, TX," *Journal of Community Health*, vol. 42, no. 4, pp. 813–818, 2017.

[7] A. Cronin-de-Chavez, S. Islam, and R. R. C. McEachan, "Not a level playing field: a qualitative study exploring structural, community and individual determinants of greenspace use amongst low-income multi-ethnic families," *Health & Place*, vol. 56, pp. 118–126, 2019.

[8] N. M. Bradburn, *The Structure of Psychological Well-Being*, Aldine, Chicago, IL, USA, 1969.

[9] F. Andrews and S. Withey, *Social Indicators of Well-Being: Americans' Perceptions of Life Quality*, Plenum Press, New York, NY, USA, 1976.

[10] E. Diener, "Subjective well-being," *Psychological Bulletin*, vol. 95, no. 3, pp. 542–575, 1984.

[11] L. A. Clark, D. Watson, and J. Leeka, "Diurnal variation in the positive affects," *Motivation and Emotion*, vol. 13, no. 3, pp. 205–234, 1989.

[12] C. Peterson, *A Primer in Positive Psychology*, Oxford University Press, Oxford, UK, 2006.

[13] J. T. Cacioppo, W. L. Gardner, and G. G. Berntson, "The affect system has parallel and integrative processing components: form follows function," *Journal of Personality and Social Psychology*, vol. 76, no. 5, pp. 839–855, 1999.

[14] B. L. Fredrickson, "Cultivating positive emotions to optimize health and well-being," *Prevention & Treatment*, vol. 3, no. 1, 2000.

[15] World Health Organization, "WHO housing and health guidelines," 2018, https://apps.who.int/iris/bitstream/handle/10665/276001/9789241550376-eng.pdf?ua=1.

[16] L. Bond, M. Egan, A. Kearns, and C. Tannahill, "GoWell: the challenges of evaluating regeneration as a population health intervention," *Preventive Medicine*, vol. 57, no. 6, pp. 941–947, 2013.

[17] Y. Gong, S. Palmer, J. Gallacher, T. Marsden, and D. Fone, "A systematic review of the relationship between objective measurements of the urban environment and psychological distress," *Environment International*, vol. 96, pp. 48–57, 2016.

[18] L. Rafaely, S. Carmel, and Y. G. Bachner, "Subjective well-being of visually impaired older adults living in the community," *Aging & Mental Health*, vol. 22, no. 9, pp. 1229–1236, 2018.

[19] Y. Tao, S. Lau, Z. Gou, J. Fu, B. Jiang, and X. Chen, "Privacy and well-being in aged care facilities with a crowded living environment: case study of Hong Kong care and attention homes," *International Journal of Environmental Research and Public Health*, vol. 15, no. 10, p. 2157, 2018.

[20] P. Pollock, M. Stowell-Smith, and M. Göpfert, *Cognitive Analytic Therapy for Offenders: A New Approach to Forensic Psychotherapy*, Routledge, England, UK, 2006.

[21] L. S. Weinhardt, P. Stevens, H. Xie et al., "Transgender and gender nonconforming youths' public facilities use and psychological well-being: a mixed-method study," *Transgender health*, vol. 2, no. 1, pp. 140–150, 2017.

[22] W. Pavot and E. Diener, "The affective and cognitive context of self-reported measures of subjective well-being," *Social Indicators Research*, vol. 28, no. 1, pp. 1–20, 1993.

[23] B. Headey and A. Wearing, "Personality, life events, and subjective well-being: toward a dynamic equilibrium model," *Journal of Personality and Social Psychology*, vol. 57, no. 4, pp. 731–739, 1989.

[24] W. L. Neuman, *Social Research Methods: Qualitative and Quantitative Approaches*, Pearson/Allyn & Bacon, Boston, MA, USA, 2011.