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Construction and Development of Smart Cities

-- Taking Chengdu as an Example

Xinrui Lu[1,a,*]

[1]*School of Architecture and Art Design, Hunan University of Science and Technology, Xiangtan, China*
a. 1810150120@mail.hnust.edu.cn
**corresponding author*

Abstract: As an important way to promote urban economic and cultural development, the smart city is an inevitable choice for future urban development. This paper first expounds on the concept and proposal of a smart city, discusses the background of the development of smart cities in China, and then introduces the current development of a smart city in Chengdu, a pilot city, and establishes a complete intelligent system to promote the operation of the city and improve people's living efficiency. Then, according to the design concept of green building, the common ground between green building and smart city development is analyzed. Taking epidemic prevention as the entry point, how to develop and play its role is discussed. The problems such as information "isolated island" and incomplete technology deployment are analyzed. Finally, some suggestions are put forward for related issues, and a bright prospect is given for the future blossoming and unlimited potential of smart cities.

Keywords: Smart city, big database, epidemic prevention and control, green building

1. Introduction

A city is the crystallization of the wisdom of human social development, with the characteristics of integrity, openness, structure and hierarchy. The degree of development of a country can be reflected in the economy, humanities and architectural facilities of its internal cities. As a new industry in urban construction, smart cities are intended to make urban development more scientific and management more effective. The use of various network communication technologies has a positive role in promoting the modernization and competitiveness of cities.

In order to promote the development of emerging industries to cope with the global financial crisis, in 2008, IBM (International Business Machines Corporation) put forward the concept of smart earth. As the core content, smart city has quickly become an important development strategy for countries to cope with the economic crisis and seize the commanding heights of science and technology [1]. As the core of modern urban development, the creation of smart cities provides the direction for the development of cities in various regions and is an inevitable choice for urban development.

Smart cities are also in line with China's national conditions, leading China cities into a new stage of development, and many cities have achieved good results in the construction of smart cities. However, compared with other developed countries, China's urban development started late, facing a series of challenges, such as too limited cognitive concept of smart city, lack of relevant concept

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system, and insufficient motivation for sustainable development. How to overcome these difficulties is a problem that China must think about in the development of smart city.

In order to promote new urbanization and effectively improve the level of urban management, according to the notice requirements of the General Office of the Ministry of Housing and Urban-Rural Development on the application of national smart cities in 2013, after evaluation and review, several smart cities have been piloted in China.

In 2021, the first batch of pilot cities in Chengdu and representative cities in the western region are going to improve the "wisdom" level of cities by adopting digital methods, and put forward ideas and ideas on how to build super-modern cities. The "14 th Five-Year Plan for the Construction of New Smart Cities in Chengdu" issued in 2022 takes "wisdom Rongcheng" as a breakthrough. Focusing on the eight smart systems of "smart government, smart medical care, smart education, smart transportation, smart environmental protection, smart energy, smart tourism and smart culture", digital transformation of urban economy will be comprehensively promoted, life and governance by establishing a large database, and analyze various data changes, so as to make the city run smarter and smarter, and also effectively cope with various emergencies. As an important city in the southwest of China, Chengdu is an important political, economic and cultural center in Sichuan Province. For Chengdu, the construction of a smart city is the best investment in urban development. With the macro-strategic direction and benchmark of the city [2], Chengdu not only attaches great importance to development, but also attaches great importance to environmental protection, advocates green development, enhances the livability of the city, and can get a sense of gain, happiness and security while meeting people's material needs.

With the sustainable and effective improvement of governance capacity and governance system, the development concept with the theme of "innovation, coordination, green, openness and sharing" has been implemented in major cities in China, and cities have been given new significance. China's smart city construction is in a special period in which four nodes coexist: strategic opportunity period, start-up growth period, bottleneck prominent period and demonstration formation period. By studying the construction and application of smart cities in Chengdu, this paper analyzes the causes of problems and solutions, enriches the content of social research, and also summarizes the construction experience and reserves the theoretical basis for more smart city construction in the future, leading China's urban development to a new stage.

2. Chengdu Smart City Construction

Chengdu is actively updating and advancing its governance model to enhance its comprehensive competitiveness and promote high-quality urban development, through a comprehensive suite of effective regional economic coordination strategies, including the refinement of industrial layouts and the enhancement of infrastructure connectivity, the economic development of the region has been significantly advanced.

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Table 1: Part of Chengdu Smart City Construction Related Policies Table

Policy name	Policy type	Policy elements	Policy content
Notice of Chengdu Municipal People's Government on Printing and Distributing Chengdu Smart City Construction Action Party (2020-2022)	Direct development type	Goal programming	By 2022, the city's smart city architecture system will be basically perfect, the "urban brain" will be fully upgraded, data elements will flow efficiently, and intelligent facilities will be widely covered.
Notice of the General Office of Chengdu Municipal People's Government on Printing and Distributing the Action Plan for New Infrastructure Construction in Chengdu (2020-2022)	Direct development type	Infrastructure	Strengthen the deep integration of 5G innovation technology with virtual reality, Internet of Things, Internet of Vehicles, ultra-high-definition video, edge computing, security technology and digital twinning, and promote the innovative application of 5G in 10 vertical areas: intelligent manufacturing, intelligent transportation, intelligent logistics, intelligent education, intelligent medical care, cultural and creative sports, technology and finance, intelligent tourism, intelligent community and urban governance.
Outline of the construction plan of the Shuangcheng economic circle in Chengdu-Chongqing area	Master planning type	Technical support	Accelerate the construction of 5G and fiber-optic ultra-wideband "double Gigabit" networks, and further promote the scale deployment, commercial application and industrial ecological construction of Internet Protocol Version 6 (IPv6).

Under the influence of digital technology, the business environment of high-tech zones has changed greatly. The government service point is an important part of the business environment, and it is also a standard to measure the business environment. It is responsible for handling various administrative examinations and approval and public service matters such as taxation and enterprise registration and accepts a large number of clerks every day. In addition to the intensive staff, clerks also need to carry a lot of paper materials, and sometimes the lack of one material will lead to the shelving of tasks and the need to spend more time and energy. To solve this kind of problem, Chengdu High-tech Zone has innovated to create "one code to get things done", and used technologies such as face recognition, big data, AI analysis, and blockchain to establish an exclusive electronic space for individuals and enterprises to save data such as electronic licenses, historical documents, and material warehouses. The "two-dimensional code for government services" generated through the electronic space can realize the submission-free and automatic reuse of office materials, which has greatly facilitated both enterprises and the masses [3].

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Not only government service points, but also high-tech zones have brought smart cities into people's lives, for example, installing induction systems on street lamps to adjust the light according to the changes of pedestrians, providing lighting while protecting the environment; The monitoring system is used on the bridge to closely monitor the final vibration, stress, deformation, temperature and other data, and alarm in advance if there is any abnormality to avoid accidents; By setting up a dedicated telephone and digital library, people's complaints can be collected, and problems can be solved in time. At the same time, the most prominent typical problems can be collected, the causes of problems can be analyzed and strategies can be provided.

Chengdu High-tech Zone gives full play to the advantages of massive data basic resources and rich application scenarios in smart Rongcheng, stimulates the value potential of data elements, enhances the supply capacity of digital technology, and focuses on promoting the innovation and development of digital industry and the transformation and upgrading of digital industry, which will make the operation of the whole city more flexible [4]. Next, the High-tech Zone will accelerate the digital transformation of the city, promote innovation in one place and reuse in many places by demonstrating applications, and continuously improve the level of modern governance.

3. Smart Cities and Epidemic Prevention and Control

3.1. Role and Challenges of Smart Cities Under the Epidemic Situation

In 2020, novel coronavirus swept all over the world, which had a great impact on human economy and health. To cope with the sudden epidemic, the new generation of information technologies, such as big data, artificial intelligence, and the Internet of Things, played a great role in accurately grasping the development trend of the epidemic and providing warnings.

In order to face the recurring and complex pandemic effectively, urban intelligent governance must transcend traditional governance models to ensure the healthy development of individuals and the stable operation of society. To achieve this, it is imperative to strengthen cross-sectoral collaboration, realize the interconnection of humans, goods, information, and circulation, and foster an interactive, efficient, and scientifically-grounded new urban governance mechanism. This approach will enable intelligent technologies to maximize their value in urban governance [5]. Relevant departments can use big data analysis technology to focus on some key areas or provinces, especially key time nodes such as people gathering, collect information on people's mobility and epidemic situation, and monitor data fluctuations. If an area is found to have abnormal data, it will have the opportunity to control the area the first time.

While technology is being used, it also exposes many shortcomings and challenges in the construction of smart cities, such as too much data coverage, many of which have no substantive role, and the needed data have to be found in the miscellaneous data, which leads to increased workload. The core problem is the lack of timely synchronization and sharing of data between communities, lots and lots, and between cities. For example, a small-scale outbreak occurred in a certain area of Pidu, Chengdu, and a medical staff in charge of logistics was preparing to order meals for colleagues, but colleagues were unable to get in touch with her in time because of their working conditions, and the number of diners and replacements was urgently needed to know. The data is too scattered and lacks circulation, which leads to the complicated workflow.

In addition, some potential problems must also be paid attention to, such as the authenticity of information, personal privacy and data confusion. If it is not properly managed, it will leave huge hidden dangers, ranging from the personal property of the people to the whole social security.

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3.2. Smart Building and Epidemic Prevention and Control

The achievement of the "double carbon" strategy needs the promotion and development of smart cities in the future, smart cities also take the "double carbon" strategy as their goal and orientation, and future cities want to achieve zero carbon and naturalization [6]. The harmonious coexistence of human beings, buildings, and environment, application of green high-tech to the construction industry, avoiding blind development, reducing carbon emissions as much as possible, making buildings get along well with the natural environment, reducing the load on the environment, making living space safe, green and comfortable, and realizing sustainable development are the concepts of green buildings, which coincide with the construction of smart cities.

With the development of today's building technology, the field has entered the intelligent era, which brings users with higher, more precise and accurate positioning requirements for building products [7]. Affected by the epidemic in COVID-19, people spend more time at home because of home isolation. Architecture is an important fortress for human beings to fight the epidemic. Safety, comfort, and health have become the priority of home life, and green buildings have also received much attention. The role of green buildings in epidemic prevention is mainly reflected in four aspects: indoor ventilation, outdoor environment, adaptability, and operation management [8].

(1) Outdoor, by integrating indoor space, the space can be divided into functional areas, and the residents' travel passages can be reasonably divided to avoid the dense population caused by single export. In addition, designers should also pay attention to the living environment, integrate artificial and natural environment, and create a suitable living environment.

(2) Indoor, first of all, designers must ensure air circulation to avoid diseases caused by air problems. For ultra-high buildings or buildings with excessive indoor and outdoor temperature differences, designers should actively popularize fresh air systems, and secondly, designers should pay attention to the lighting of rooms. Green buildings can achieve lighting effects by lighting wells and patios outside windows. At the same time, the influence of surrounding buildings on lighting should also be taken into account to ensure that residents can see the natural environment and have qualified vision.

(3) Barrier-free access in the building is connected to the outdoor site, and a barrier-free stretcher elevator is set up. If residents have a sudden infection and need to see a doctor immediately, it is convenient for stretchers to enter and exit from emergency vehicles. In public buildings, green public buildings can quickly change the building function and layout during the epidemic period, such as transforming into square cabin hospitals, material warehouses, isolation wards, single-room offices, etc. [8]. Based on not destroying the original structure of the building, partition walls are used to improve the reuse rate of the building.

(4) In terms of management, health information collection equipment, such as a non-contact human body temperature detection system, is added at the entrances and exits of buildings or other key areas, user health status modules are established, management systems are formulated, and technologies such as blockchain, 5G and big data [8]. In terms of material services, green residential quarters can set up supermarkets for supplying grain, oil, fruits, and vegetables, set up take-out cabinets or self-help express boxes, implement "zero contact" distribution, reduce the frequency of residents' travel, carry out regular health promotion, and actively guide residents to live a healthy and isolated life.

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Table 2: Comparison of environmental characteristics requirements between prevention and control measures of communication in COVID-19 and green and healthy buildings

Project		Measures to prevent and control the spread of COVID-19 virus	Requirement for environmental characteristics of green and healthy building
Guiding documents, technical standards and research results		1) Operation and Management Guide of Air Conditioning and Ventilation System in Office and Public Places during COVID-19 Epidemic; 2) T/ASC 08—2020 "Instructions on Emergency Measures for Operation Management and Use of novel coronavirus in Office Buildings"; 3) Research results and suggestions of experts and scholars	1) GB/T 50378—2019 Evaluation Standard for Green Buildings; 2) JGJ/T229—2010 Code for Green Design of Civil Buildings; 3) T/ASC 02—2016 Evaluation Standard for Healthy Buildings; 4) Technical Essentials of Healthy Housing Construction
Main technical points	Outdoor environment	Crowd activities should be in the green residential space with good air flow, no pollution or less pollution and lush plants.	1) Building planning and layout should create a good wind environment to ensure comfortable outdoor activity space and good natural ventilation conditions; 2) Three-dimensional greening and multi-layer greening are adopted in the site, and the plants are arranged reasonably.
	Indoor climate	1) The building should actively open the window for ventilation every day; 2) All household exhaust devices are started during ventilation; 3) During the period of air conditioning and heating, the residential building should keep a certain opening of the external window.	1) The plane space organization layout of buildings should be conducive to organizing indoor natural ventilation and forming through flow; 2) Take measures such as wind guiding wall, wind catching wall, air well drawing and solar air duct drawing to strengthen the natural ventilation inside the building; 3) The planning and layout of residential areas should be consistent with the local dominant wind direction, forming airflow channels and making full use of natural wind; 4) The room should be naturally ventilated. Under the condition that the outer window is sealed, there

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Table 2: (continued).

			should be an adjustable ventilation device to supplement fresh air; 5) The kitchen and bathroom space should be well organized with air inlet, air outlet and airflow direction, and full or partial ventilation facilities should be adopted to prevent backward flow, cross-talk and odor of flue gas in the public exhaust duct; 6) control decoration pollution
	Ventilation and air conditioning system operation	1) All-air system should be operated by fresh air; 2) The fan coil unit plus fresh air system shall ensure that fresh air is directly taken from the outdoor; 3) The fan-coil system without fresh air and the split air conditioner at home should open doors or windows when running; 4) Air conditioning and ventilation system should be cleaned and disinfected.	1) Fresh air volume meeting indoor air hygiene standards should be adopted; 2) Choose a reasonable air supply and exhaust mode and flow direction, maintain an appropriate pressure gradient, and effectively eliminate indoor pollution and odor; 3) A mechanical exhaust system should be installed in the room that produces odor or pollutants, and the exhaust air should be directly discharged to the outside.

4. Conclusion

In addition to Chengdu, pilot cities such as Shanghai, Guangzhou, Hangzhou and Chongqing are actively building smart cities. As an important force to promote economic and cultural development, smart cities are not only the development of technology, but also the effective and sustainable improvement of people's quality of life, with the ultimate goal of enhancing people's sense of acquisition and happiness.

Now, a smart city is a new beginning in China, which has great development space. While pursuing rapid development, the public should pay more attention to the quality and safety of development, how to make the city green and environmentally friendly, how to make the city green, how to plan and manage the city reasonably, how to deal with all kinds of emergencies and so on. All these need to find solutions, such as developing relevant AI artificial intelligence technology, intelligently screen massive data anytime and anywhere, filter useless information, ensure the immediacy and accuracy of data, and increase deployment efforts. Accelerate the establishment and improvement of digital government and related laws and regulations, provide high-quality management of databases, prevent irrelevant personnel from contacting data, avoid information leakage, and ensure that users' privacy is not infringed; Mobilize people to actively participate in digital popularization, carry out course study, guide the contact of related apps, let people know more about digital cities, build a strong public foundation, and let smart cities play their roles to the maximum extent. In addition, any development can not be built at the expense of the environment, but also pay attention to the development of green and green buildings, create a good living environment, and promote a new mechanism of green, scientific and efficient urban governance to promote the harmonious coexistence between cities and the environment.

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Undoubtedly, in the future development of China, more and more smart cities will appear in public view, and smart cities will blossom more and show infinite vitality.

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