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Smart objects for smart cities —— the use of internet of things in public spaces

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SECTION

□ Design for Social Innovation (Political design, Co-design, Service design, Culture 3.0)

ABSTRACT

Urban public space is the second habitat for people other than their home. It is also a spiritual place related to the city identity in which is meaningful for the construction of smart cities. The current smart city model prioritize the technology and information connection. However, city is a sophisticated entity .Each city is unique, with its own historical development path, current characteristics and future dynamic. As the developing of smart cities in the future, the city identity should not disappear but be protected with a new scenario, such as with Internet of Things technology. City public space design can co-work with the Internet of Things technology to build city way-finding system.

In this case, in order to have a clear scenario about how the cities connect with people, both natives and strangers, this paper will firstly discuss about the urban infrastructure design and public space design in the cities in some different parts of the world, base upon its history, geography, architecture, culture, etc. Secondly, based on the understanding of the various elements of the city, combine with Internet of Things technology, rethinking profoundly the construction of smart cities. last but not least, based on the view of protect culture diversity, this paper aims at discussing the possible ways to building up the city identities, and contributes to provide a proposal for the sustainable development of the smart city.

KEYWORDS

Urban IoT ; Smart City; Infrastructure design; Identity design

Introduzione

Like the stars are flashing in the night sky, the ground is flashing with the urban civilizations from different regions. With the development of smart cities, people gradually intend to using technology to design a "smart brain" for cities to solve urban problems, such as traffic congestion, unfair allocation of medical and education resources, environmental pollution and so on. According to the 2014 revised report from United Nations Population Outlook, by 2050, 66% of the world's population is expected to live in cities. As always, a new urbanization calls for a new urban civilization. Lewis Mumford divided the development of human cities into three stages: ancient Egypt, ancient Greece-Roman cities; medieval Christianity, baroque and commercial cities; modern industrial cities. In the era of modern industrial cities, the manufacture allowed us to produce steel concrete and large glass massively. This has also changed the face of cities, which are more homogeneous than ever before. However, the spiritual ethos root in the city's history is a unique treasure that can be perceived by people, and it is an important foundation for the citizens' high quality of life. Take history as a mirror, as humanity moves to a more high-tech urban development— smart city, we should avoid our inertness in chasing the petty favors of technology (especially in Asia and Africa, where the urbanization process is fast) .Instead, we should give full protection and respect to the history of the city by systematic thinking.

The construction of smart city is based on cloud computing and big data, all of which require a complete urban infrastructure system to support, including infrastructure in urban public space. Many cities in the world today have begun to pave infrastructures for smart cities. For example, in China, in 2018 Shanghai published the "urban fine management" policy and "urban furniture design" concept, in order to embellish the fair image of smart city for the future. The city public space is the window of the city's temperament, it is the place where the city residents express themselves and emerge the empathy psychology, and it is also an important way for the strangers to understand and explore more the city.

Therefore, in the era of smart cities, how to combine with high-tech to design urban public infrastructure is worth of our consideration. This article will focus on the Asian urban background discuss the design of urban public infrastructure and compare with other countries. Based on the urbanization problems in China's transition society, enumerate and analysis of urban public infrastructure design, and explore the possible optimization design methods.

Design of Urban Public Facilities in China under the Context of Smart Cities

Nowadays in China, the urban-development model emphasizes industrial economy in which development based on the urban land, in order to enhance the economic value of the urban land. At the same time, the Internet has facilitated new economic models in China, such as the Self-Media, Fan economy and the Sharing Economy. People's "self-centered" and "experience-sharing" psychology is growing. Along with these phenomena, comes the fact that folk's mediocrity and laziness of aesthetic unconsciously.

1. Improving the humanistic competitiveness of Smart Cities——Protecting Urban History and Culture.

There are many highly recognizable native public spaces in Chinese cities that have evolved from history. Traditional Chinese culture focuses on the connection between nature and people. The construction of traditional cities, in most plain areas in china, basically includes four elements: forest, water, house and farmland. The structures sometimes are different due to the different water system and geography. For example, water system is plenty in south part of china(south of the Yangtze River, in which we call it Jiangnan), so the public space and water system are integrated together and formed the water market in Jiangnan(Fig.1). In the north, in Beijing's old town, the space for public activities is about Hutong culture (Fig.2), which is dominated by neighborhood communication. In the west, in Sichuan province there are public space called Jinli (Fig.3). There are also "bamboo forests" and " Orchid Pavilion " (Fig.4)that inherit from Song Dynasty.



Fig.1 - water market in Jiangnan

Fig.2 – Hutong in Beijing

Fig.3 - Jinli in Sichuan province

Fig.4 - bamboos and Orchid Pavilion

However, in China, the study of infrastructure design in traditional urban spaces in the view of new technology is rare. Only a few universities and research institutions are attempting to quantify and preserve the spatial texture¹ of cities using computer parametric software. For example, CityEngine (CE) software is used to parametrically parse and reconstruct spatial texture in an old town. Nevertheless, using new technologies to design urban infrastructure in historic districts will make space more layered and make the interaction between people and space more life-style rather than in modern districts. In China there is a well-known example about the use of modern technology and design to transmit the spirit of history—Suzhou Museum, which was designed by I. M. Pei. The museum complex are minimalism style. Opposite to most of famous Chinese buildings, it is not high, not big, not prominent. Locate in the city's historic block. Space scene design are completely use of native bamboo (Fig. 5), wood, stone (Fig.6). Introduce Suzhou's typical space scene "small bridge and flowing water's with dwelling ". Although there is no technologies such as Internet of Things, the understanding of using contemporary design to prolong the vitality of the ancient space is vivid. This kind of unscramble on design can be also applied to the infrastructure design in smart city public space.

People creates space, space affects people. Using technology such as digitalization and the Internet of Things to analyse cities can improve functional level of public spaces in historical cities. Including social, economic, environmental, human activities and so on. In European countries, the digital design of urban infrastructures are common. For example, designers use new technology in ancient buildings to convey the artistic atmosphere or to provide some information. (Fig.6,Digital Media Art in Florence, Old Bridge)



Fig.5 – native bamboos

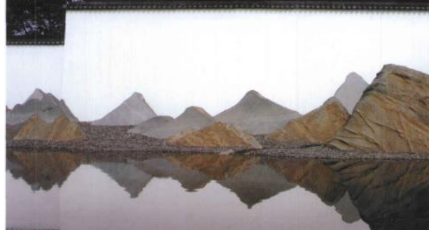


Fig.6 – native stones and native landscape



Fig.7 - digital media art in Florence

2. Urban Public Infrastructure Design Base on China's Transformational Development.

Background: According to 2012 data from China's three major telecom operators (China Mobile, China Unicom, China Telecom), more than 50 cities in China have begun to build "smart cities", including first-tier cities such as Beijing, Shanghai, Guangzhou and Shenzhen, and some eastern coastal cities such as Hangzhou, Xiamen and Zhuhai. In October 2017, Hangzhou Alibaba Cloud Co., Ltd. launched "ET City Brain 1.0" to solve the problem of urban traffic congestion. In fact, compared with these technical problems, Chinese cities are facing a more important urbanization problem, that is the loss of urban identity. Currently, China's cities are mainly industrial development, cities far away from nature, urban public space gradually shrink and commercialize. Residence in Chinese cities are community-style housing and built by the real estate developers, and the buildings are all skyscrapers. Therefore, the face of China's cities has become a "skyscrapers jungle, one face for thousand cities". If the construction of smart cities is based only on reinforced concrete complexes without spiritual identity and symbolic memory, then it is difficult for the cities to have sustainable vitality.

China's academic community has recognized the problems and is beginning to make changes. In November 2017, Tsinghua University's Department of Urban Research and Planning partnered with MIT, established a laboratory focused on research and innovation practices in China's urbanization transformation: MIT China Future City Lab. The lab includes an academic team of Chinese youths, CitoryTech. Commitment to improving the construction of urban culture. They use techniques such as Location Positioning (LBS) , virtual Reality (AR) and Artificial Intelligence (AI) to record natural images of streets and depict urban visual environments(Fig.8, Fig.9). Proposing a deep learning method to simulate the emotional perception evaluation of urban street scenes by individuals. To some extent, this answers the question: "What visual elements most affect people's feelings in space?"²



Fig.8 - Image from CitoryTech lab



Fig.9 - Image from CitoryTech lab

Traditional craftsman in China's Yungui Plateau and Qinghai Plateau are helped by Roots Studio laboratory at MIT. Roots Studio establishes the digital center for their art works and expands their art works to the world's first-tier retail brands(Fig.10). To avoid the loss of the cultural heritage of craftsman due to rapid urbanization.



Fig.10 - Image from Roots studio lab

Cases of Design Urban Public Infrastructure with Technology

Compared with China, other countries have better preserved cultural history, and the combinations of urban public facilities design and technologies are more interactive. This is a worthwhile reference in the design of urban public facilities for China. In Germany and Japan, for example, many new media research institutions have integrated digital media art into the design of urban public facilities and interacted with the public. "Message Pilar" (Fig.11) designed by Teamlab, located in Tokyo City Square. It looks like an ordinary streetlamp, but it is actually a public art installation. The public can send their messages to "Message Pilar" via the mobile app. People who use the same app can see messages edited by others. Finally, all the information comes together to form an information tree. "A luminous musical swing" (Fig.12) was designed by the designers from Canada. When the swing sloshing, different frequencies produce different melodies, and different melodies blend with each other, finally finish a music together.



Fig.11 - message Pilar



Fig.12 - A luminous musical swing

There are also many advertisements in different countries that attract customers by using public spaces to engage strangers. For example, McDonald's has launched a game for pedestrians on a big screen on a street in Stockholm, Sweden. Pedestrians can play virtual table tennis with another person after connecting to the screen via a mobile phone. The winner will get a McDonald's food voucher. Reebok once placed a shoe cabinet on the street. There is a speed measurement device on the cabinet, as long as the passer-by can run faster than the preset speed, they can get free reebok running shoes. Another example, British Airways also posted a video on a big screen on the street. The video shows a little boy walking in the direction of a plane as it passes through the street. Information about the plane will also be displayed on the screen.

Although these are commercial cases, they are also another level of public space facilities design. Use creative design to guide civic interaction, which makes full use of the city's public spaces.

Smart urban public Infrastructure design in the future

Back to the beginning of the article. Each city is unique, has its own historical development path, current development characteristics and future development dynamics. In the vision of the future smart city, people can live in the modern and based on the local history. In this way, the smart city can be development with connotation, the quality of citizens' life can be guaranteed.

To sum up, the design of the public facilities of smart cities should achieve these aspects: Build people-to-space, people-to-people emotional interaction, promote social harmony; Respect the cultural history of the cities and the residents' original living habits; Show a friendly city interface, providing information to strangers through inclusive design.

Notes

¹ "Spatial Texture" is a kind of research about urban planning. Integrating Color, Texture, and Spatial Features for Image Interpretation of the city.

² Excerpt from <https://www.citorytech.com/>

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