Study of Chinese City "Portrait" Based on Data Visualization: Take City Dashboard for Example

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Abstract. The purpose of this study is to consider the case study summarizes the characteristics of urban dashboard, and with the help of literature research to analyze the necessity and difficulties of urban dashboard design in China at this stage. In the second part of this paper, we give a brief overview of smart city and urban dashboard, summarize the importance of data visualization in the construction of smart city, and emphasize the outstanding performance of using urban dashboard in this data to better serve the public contribution. Then the third part of this article based on the previous study of the city dashboard, summed up the six characteristics of the dashboard. And through six typical urban dashboard cases to explain these six characteristics in detail. In the fourth part of this article, we propose the possibility and difficulty of designing the urban dashboard of China considering the national conditions of Chinese characteristics. In the fifth part of this article, we summarize and prospect the research work done so far.

Keywords: Smart city · City dashboard · Chinese city

1 Introduction

Urban dashboards enable the visualization of key data from the city's operational core system, making the city's service system feel sensible. The construction of an urban dashboard will contribute to the construction of a smart city, better serve the public, satisfy the needs of the public and enhance the quality of life of the public. The ultimate goal is to promote harmonious social development and efficient allocation of urban resources.

2 Related Research

2.1 Smart City and City Dashboard

The migration rate of urban population in the world is increasing at an alarming rate. According to experts, by 2050, 70% of the world's population (more than 6 billion people) will settle in urban areas. In the past 10 years, the concepts of "digital city", "big data city", "smart city" and "smart city" have become a heated topic in academia

and social media. The construction of smart cities provides a new way of thinking for the transformation of cities in twenty-first Century. "Smart city" is actually a more advanced form of "data city". The degree of openness of a city affects the intelligence of the city, and ultimately determines the convenience and livability of urban life.

According to Pike Research's research on smart cities, the market for smart cities was valued at $100 billion by 2020. The application of smart city is very extensive, such as smart energy, intelligent transportation, intelligent building, intelligent education and so on. Microcosmic includes community, health care, hotel management, aviation, retail, entertainment, waste disposal and other industries. It is an inevitable choice for the construction of China's smart cities to construct a data center system based on large data to run the city. It is the inevitable choice for the construction of China's smart cities [1]. On the basis of the construction and development of smart city building in different areas of data resources to fully integrate and use general data, information process of an industry or a region can be divided into two stages, the first stage is digital, it includes information sensing, computing, storage, transmission and control network and digital; the second stage is intelligent, is the higher stage of digitization, introduces the concept of intelligent, digital into various forms of sensible [2]. According to this theory, urban digitalization can be divided into two stages: the digital city (Data City) and the intelligent city (smart City). The management and service of cities are continuous, and there will be huge amounts of data generated. The characteristics of these big data are large capacity, variety, high speed and high value. These data will reflect the characteristics, laws and changes in the process of urban operation. The opening and sharing of these urban data will greatly affect the pace of the construction of intelligent cities. A lot of data are collected by citizens and government agencies, which are becoming more and more open to public use. Through the analysis of these data, the intelligent city management can provide the decision-making basis, and can provide new insight for the service system of the intelligent city. Data visualization is a common means of data analysis. Visualization technology is a theory, method and technology to transform data into graphic or image form to screen and interact with each other based on computer graphics and image processing technology. The main features of data visualization technology are interactivity, multidimensional and visibility [3].

Using data visualization method, we can better connect and share these data and information, enhance the presentation effect of data, facilitate users to observe data in a more intuitive way, and find hidden information in data, and effectively use data. Data visualization is a scientific and technological research on the form of visual representation of data. To sum up, the city dashboard based on data visualization came into being.

2.2   The Value of City Dashboard

City dashboards need to integrate different platform data and different business data in urban operation process, including data collection in municipal, police, transportation, power, business and other fields. Combining with the geographic information system, monitoring camera images and GPS data, building three-dimensional data and many other types of data, a comprehensive display of the status of city operation, including:

the characteristics, economic vitality of tourism, transportation, public security, human services, entertainment and culture, environmental sustainability, citizen participation in governance in areas such as [4]. Control the city dynamics in a full range. The city dashboard is a summary and summary of various indicators of urban operation, showing the overall operation of the city and guiding the healthy, scientific and intelligent operation of the city. Through the management of urban operation signs, we can monitor the objects of urban operation and management, excavate the inherent laws of urban development, and provide a deep insight for urban life [5].

Which section of the city is congested? How many cultural activities are going on? Where is the construction in the construction? You can get to know your city in real time through the city dashboard. There are two forms of dashboards in the city: dashboard, which is a part of control and command center, or citizen participation, which allows public and urban workers to explore urban data. The former tends to focus on a specific system, such as monitoring internal traffic or safe cities, and the city system of the command center [6]. The dashboard of the city converts data into accessible information, information search and use. It is a carrier tool to directly communicate with users and help users to make decisions. As the collected vital signs from a macro perspective to research and control of the body, through the data and information collected in the monitoring of the city, on the data and information analysis form the overall judgment on the situation of the city, take effective measures to dispose of the city operating problems of the specific situation, the city is always in good condition, for monitoring and early warning, scientific analysis and objective evaluation of city operation, auxiliary decision-making, so as to improve city environmental protection, intelligent transportation, emergency command, infrastructure, public security and other aspects of the comprehensive management level. We have summed up the importance of the city dashboard. The dashboard can not only create good local democracy, but also provide opportunities for learning. A dashboard is simply a way of presenting a source of knowledge to understand and handle the complex reality of cities [7].

3   Case Studies on City Dashboard

The city is made up of many elements. The dashboard displays these elements as the following categories: transport, environment, statistics, economy, community, culture and security. The goal of a city dashboard is to present all the data, graphics, and other results in the most readable way. Through the rich interactive query function, the gorgeous data display form, the visual effect of film and television level, help urban managers improve the efficiency of urban management. In order to achieve the comprehensive management of city comprehensive status. Based on the comprehensive analysis of dashboards in dozens of foreign countries, we summarize the six characteristics of city Dashboards: recording, connectivity, sensing, interaction, adaptation, and integration. We will give a detailed illustration of each of the features of the dashboard.

Record

The first step of the process of city data visualization is to record all kinds of large data produced in the process of city operation. The sources of these data can be roughly divided into three categories: orientation, automation, and voluntary [8]. Through all kinds of sensing devices and application systems, data can be recorded throughout the whole process, and then provide data basis for subsequent services, and provide support for analysis and decision making. The next picture is a city dashboard on London's daily real-time situation. For example, you can see information on the "dashboard", such as the weather and the running state of the subway station. In this corner, there are cameras and their network. In addition, there are a series of data, such as market operation and so on. This series of data will give users a good overview of the city. They can know what is happening in the city from any angle, and these data are continuously uploaded (Fig. 1).
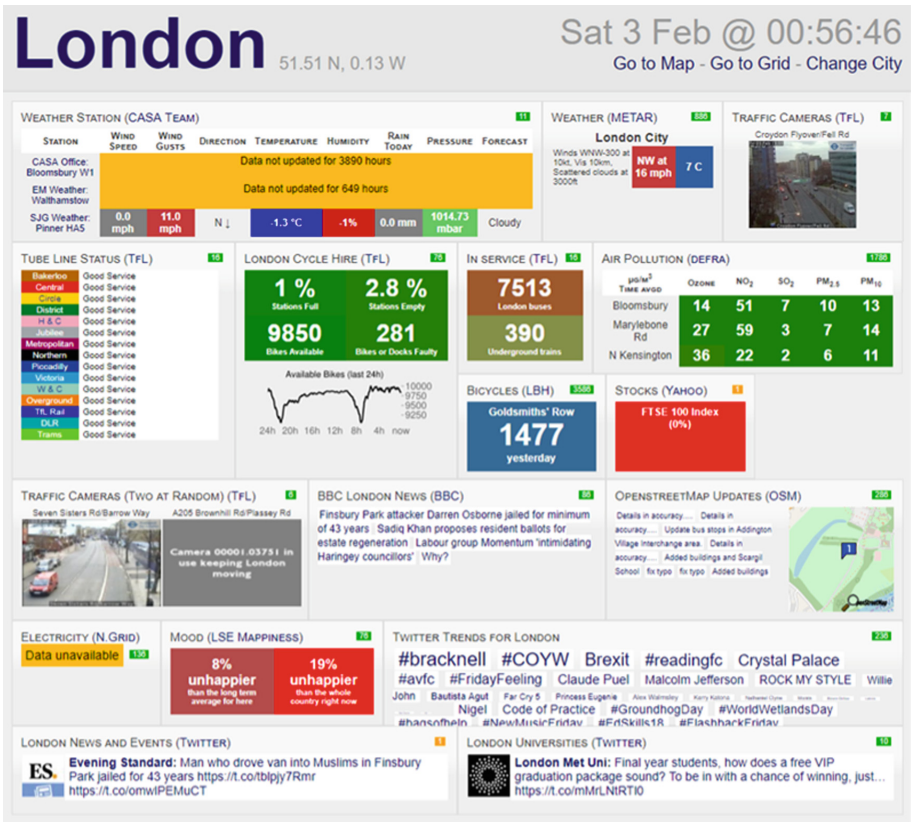
Fig. 1. London Dashboard

Connectivity

Connectivity means connecting and interworking. The Dublin dashboard is exactly the feature of connectivity.

Through the ubiquitous devices (street lights, video monitoring probe, LED, network camera, touch screen, wireless network, microphone, camera, sensor, infrared detector, mobile phone, computer), collected from different departments of data integration, city instrument panel to create a seamless connectivity, users can use the city whenever and wherever possible dashboard. This concept will be connected to separate from the physical space, and the use of personal computer or mobile device screen using in any place, through all kinds of APP better divergence of city services, so that we can more easily share the same vision information in scattered population, regardless of who is to expand public officials and technical personnel, or all residents of the city. But the current problem is that the number of APP is too large and needs to be further integrated to promote "connectivity" (Fig. 2).

Sensing
It is an important link in the process of city data visualization to understand all kinds of large data produced in the process of city operation. Through all kinds of perceptual technology, we can fully perceive the city environment, understand the social relationship, quickly discover the trend, and deal with the complex relationship. In order to achieve this goal, it is necessary to start from the foundation, that is, to collect the data fully through the perceptual technology and the means. This is an Irish Kirk dashboard. You can see that these dashboards are starting to add some practical functions, which can guide people to perceive real-time data. Some simple diagrams can also be used to translate data and visualize the trend of data development so that users can better understand the characteristics of data change. This is a positive exploration of the city dashboard. This information is captured with sensors and city maps, and can get real-time data updates, directly control the overall situation and respond to the problems in time (Fig. 3). Without this processing of the data, we really can't perceive the real time and the details that are happening at different locations.

Interaction
Interaction defines the content and structure of the communication between two or more interactive individuals, so that they cooperate with each other. Interaction includes two aspects. From a microcosmic point of view, it is possible to query the data you want to know at any time and need more practical means of inquiry. For example, Leeds city dashboards can use various ways of interaction such as point selection, adding, zooming and narrowing, to achieve good user experience and provide rich presentation and interactive functions. From the macro perspective, the overall environment of man-machine interaction can be realized in such a system, users use the behavior of Leeds city the dashboard itself is the city, a variety of intelligent devices and combine into an organic whole, and analyze the situation of the city found that the real-time response service city takes place in real time (Fig. 4).

Adaptation
The dashboard is the city data visualization, the real time display of the city intelligence index, to help the government to simplify the process of identification from the problem to the solution. Based on all kinds of basic information, including the information of perception and recording, it provides users with accurate and personalized urban data services. A reasonable and effective dashboard design should be investigated in a
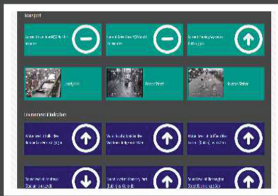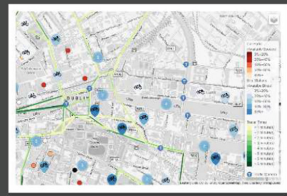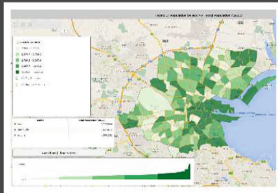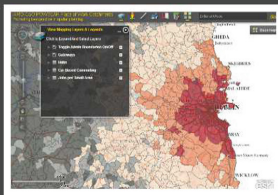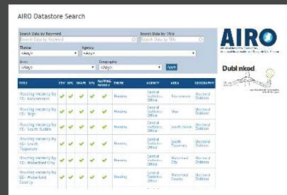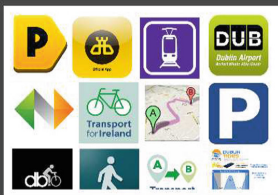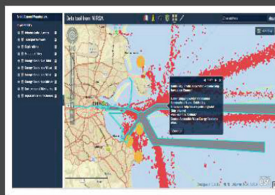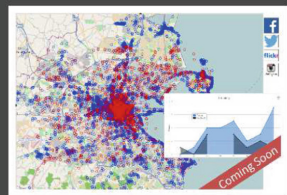
Fig. 2. Dublin Dashboard

Fig. 3. Cork Dashboard
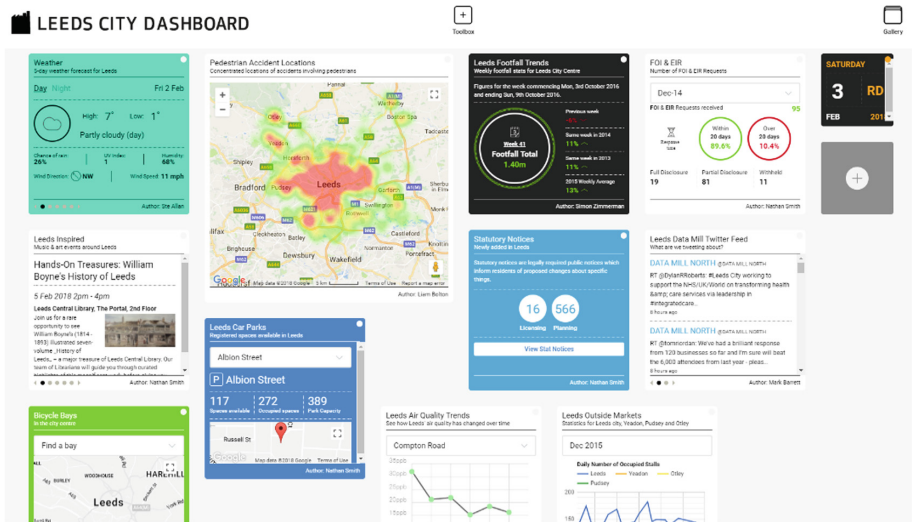
Fig. 4. Leeds Dashboard

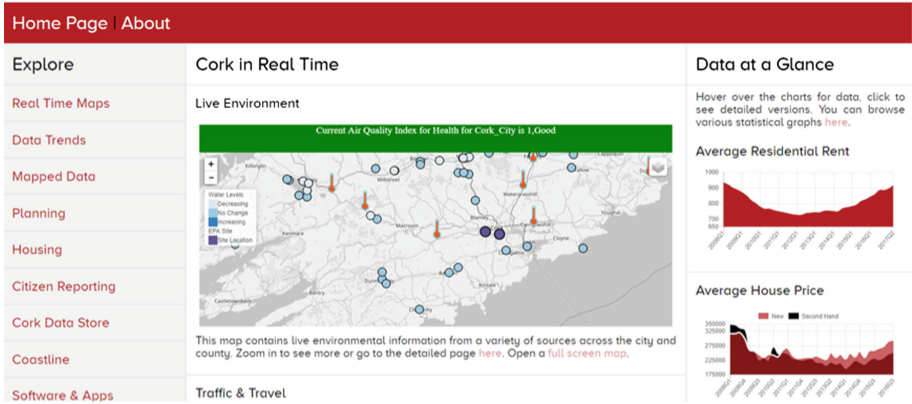comprehensive way, providing customized products and services based on local characteristics and needs of citizens. The Glasgow dashboard is a typical case of the user's self - customization. The "passive service" of the city dashboard is transformed into "active service". It allows users to customize their dashboards according to subway, catering, entertainment, news and other modules, giving users more freedom to choose independently, which is loved by users (Figs. 5 and 6).

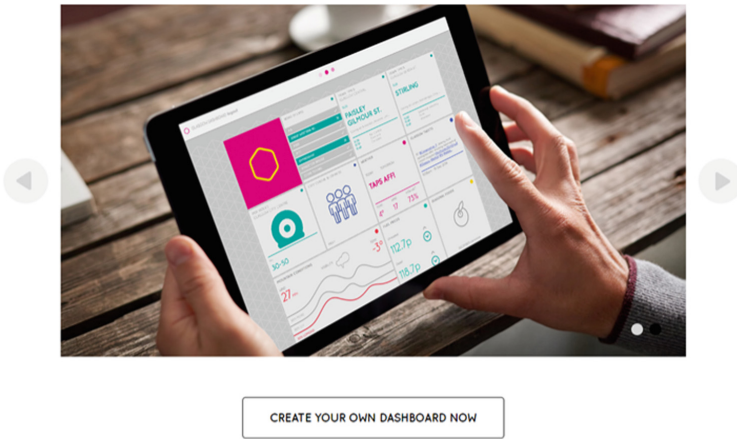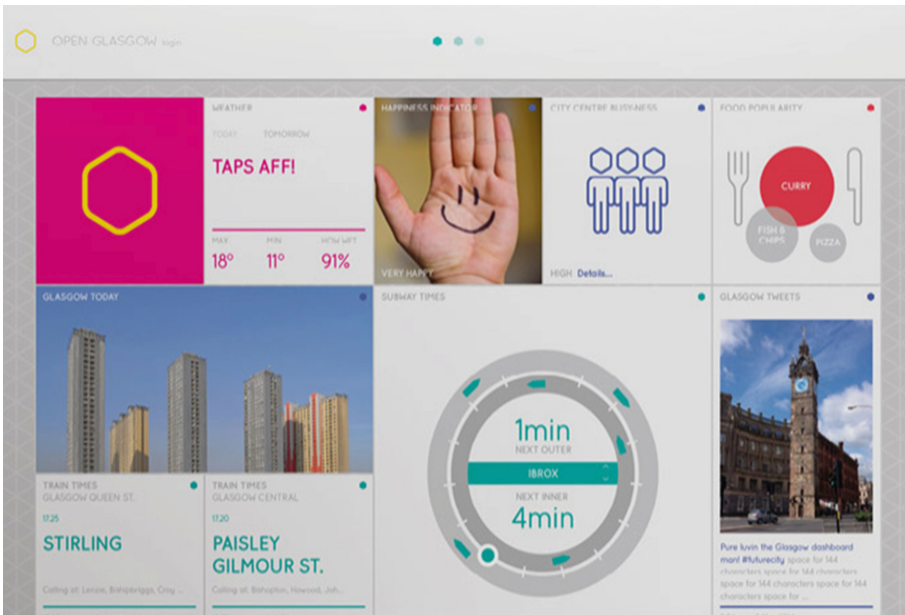**Fig. 5.** Glasgow Dashboard

Fig. 6. Glasgow Dashboard

Integration

It will open and integrate all kinds of information, resources and services collected during the dashboard process, so as to provide better information services for users. Based on the coordinated integration of urban data, the work efficiency is enhanced and the satisfaction of the citizens is improved. San Diego City dashboard for different departments in the field of data, mixed data and many departments, need to observe and analyze from different angles, the data according to the theme, systematically presented, for city managers to master the rules and significance of data in different dimensions, to understand the city running situation. Through the case of San Diego can be seen, along with the rise of the network of the city, people pay more and more attention from all aspects of collection, processing and analysis can realize the precise management of all areas of city data, realize the accurate and convenient city life service, data service to embody the people-oriented (Fig. 7). With the city dashboard as the carrier, the data will be fully integrated, excavated and utilized, and the new dynamic mode of the city will be more and more knowable and controllable [9].
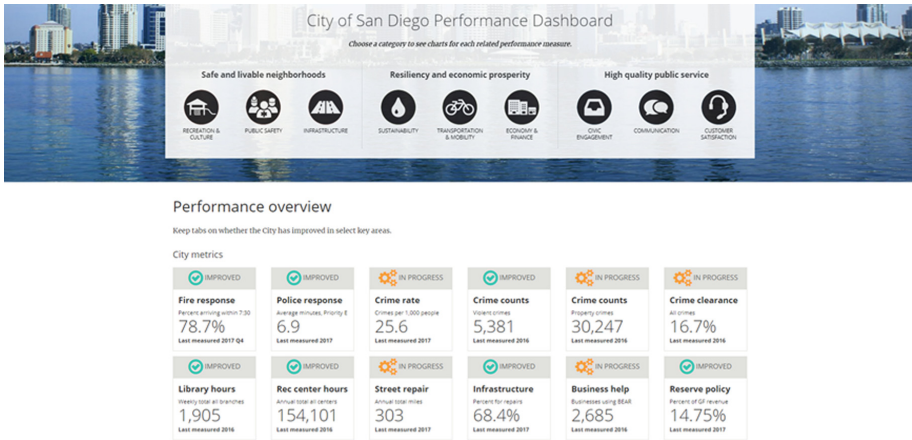
Fig. 7. San Diego Dashboard

4 The Efforts to Design Chinese City Dashboard

4.1 The Necessity of Building Dashboard in China's Cities

(1) China is actively building smart cities

Since the concept of intelligent city has been put forward, the enthusiasm for construction in all parts of our country has been constantly rising. At present, 290 cities have been selected for the pilot of the national intelligent city, which will bring convenience to the life of the urban residents. After several years of construction, the intelligent city is changing from planning to reality in our country. It is expected that in the year of this year, the number of intelligent cities in China is expected to be more

than 500. Industry forecasts, with the development of local smart cities, the scale of the market will be expected to expand to hundreds of billions of yuan, or even trillion yuan.

(2) China is opening a lot of data gradually

Chinese after nearly thirty years development, government departments and business system data reserves have been very mature, in Chinese, the most complete, most large and the core data, the accumulation of a large number of governments at all levels and the public life and production related data, such as: meteorological data, financial credit data, data and power data and gas data, tap water data, traffic data, passenger safety data, criminal case data, housing data, customs data entry and exit data, tourism data, medical data, education data, environmental data, is the largest holder of government social data on how these sleeping through data fusion, to extract key data analysis, mining, and use real for the city manager, city control situation, The real realization of the intelligent city, the government has begun to work, China's big data enterprises are also working for it.

(3) The continuous development of infrastructure and science and technology

In recent years, urban basic design and intelligent data technology have developed rapidly in China. In particular, wireless sensor networks (WSN) are widely used in the intelligent management and control of urban facilities, safety, traffic and environment. With the development of Internet, mobile Internet and Internet of things, the connotation and application of smart city are more and more abundant, and gradually change all aspects of people's life. Based on the data visualization form of the city dashboard, we can help build a channel between the public and the public data, so that people can conveniently and simply use open data to explore and explore, so that the value of these public data can be exerted.

(4) Urban services need to be upgraded

The wisdom city of China is the pursuit of building a world - class Intelligent City, which is based on strengthening the city supervision and service and completing the construction of information infrastructure. The urban service in China emphasizes the needs of the people's livelihood, and takes people as the core and the needs of the people's livelihood as the starting point. Urban dashboards can quickly find the trend of urban data development and deal with the problems of complex cities. Therefore, the introduction of urban dashboards in China can help Chinese cities build public platforms and effectively improve the quality of public services and the efficiency of public services.

4.2 The Difficulties Faced by China in Building the City Dashboard

(1) Social participation is not enough

A lot of data are collected by citizens and government agencies, which are becoming more and more open to public use. Users use the dashboard process to fully display the open content and form of urban data, and can provide personalized

customization. To mobilize users' participation in the development of city dashboards from bottom to top will help encourage public participation in urban dashboard research, improve residents' understanding of urban services and maximize public interest, thereby enhancing community stickiness and vitality. As rob and others pointed out, dashboards need to provide new solutions on the basis of understanding the needs of cities, but there is confusion or reduction of the reasons why it is difficult to perceive or simulate [10].

(2) **There is a regional imbalance in infrastructure and development**

The gap between urban and rural areas in China is huge, and the development gap between cities is also large. Different data visualization construction targets are set for different regions of the same town. For the metropolis with high urbanization, such as Beijing, Shanghai and Guangzhou, smart city construction is more emphasis on further improvement of the existing infrastructure network and public services, combined with the development of the new generation of IT industry, promoting the coordinated development of urban and rural areas. For a relatively low level of urbanization, more emphasis should be laid on consolidating the foundation of urban construction at the present stage, such as infrastructure construction and capital investment, so as to lay a solid foundation for subsequent urban data collection and processing.

(3) **Lack of relevant visualizations**

In the face of the challenge of information explosion, almost everyone is exposed to various forms of information visualization. Through data visualization, we can create a channel between public and public data, so that people can conveniently and simply use open data to explore data, so that the value of these public data can be exerted. Professional designers and developers can understand how people read, understand, explain and distinguish the visualization of various forms, and puts forward how to improve the technology innovation management scheme to consider from the user's point of view, to help government departments to monitor the city service status, forecast the development trend of city services. However, the number of talents and universities in China is relatively small, and the lack of talents has become a major reason why China has not yet developed its own dashboard.

5   Conclusion and Future Work

In the future city dashboard can also have more and better, for example, the establishment of city children lost face recognition system, classification of garbage city better, monitor the recovery process of waste batteries, avoid pollution two;,,,, park trees growth are all can be uploaded to the cloud data visualization, perceived the intersection of the vehicle at the intersection of the sensor; improve the efficiency of traffic intersection; provide the city near the city parking information, and choose an optimal route to the public, and real-time navigation etc. The city dashboard will be an indispensable foundation for the future collection, perception, visualization, processing and sharing of big data regardless of whether it supports government decision-making or urban services. Take the city dashboard as the carrier, based on the data

visualization, and show the society through the innovative way, and optimize the service function of the city.

There is no doubt that the construction of smart cities is a huge and complex project, and we believe that the city dashboard will make a better life in the city. However, more efforts and efforts are needed to try to link China's urban service needs with dashboard tools. Many of the problems involved are waiting for people's further thinking and answers.

References

1. Zhen, F., Qin, X.: The application of big data in the research and planning of intelligent city. Int. Urban Plan. **29**(6), 44–50 2014
2. Li, W.: Several key technical problems on the intelligent transformation of "digital city". Global Finance **6**, 72–78 (2015)
3. Ren, Y., Yu, G.: Research and development of data visualization technology. Comput. Sci. **31**(12), 92–96 (2004)
4. Elmaghraby, A.S.: Visual data analytics for an event city. In: Ajman International Urban Planning Conference Aiupc 7: Planning for Event City (2015)
5. Piovano, L., Garrido, D., Silva, R., et al.: What (Smart) Data Visualizations Can Offer to Smart City Science, 96. Social Science Electronic Publishing (2014)
6. Mcardle, G., Kitchin, R.: The Dublin dashboard: design and development of a real-time analytical urban dashboard. In: ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, vol. III-4/W1, 19–25 2016
7. Kitchin, R., Lauriault, T.P., McArdle, G.: Urban indicators and dashboards: epistemology, contradictions and power/knowledge. Reg. Stud. Reg. Sci. **2**(1), 43–45 (2015)
8. Kitchin, R.: The real-time city? Big data and smart urbanism. Geojournal **79**(1), 1–14 (2014)
9. Kitchin, R., Maalsen, S., Mcardle, G.: The praxis and politics of building urban dashboards. Geoforum **77**, 93–101 (2016)
10. Kitchin, R., Lauriault, T.P., Mcardle, G.: Knowing and governing cities through urban indicators, city benchmarking and real-time dashboards. Reg. Stud. Reg. Sci. **2**(1), 6–28 (2015)