The Application of Big Data in Intelligent Street Design

Sun Erhua

Chongqing Real Estate College, Chongqing, China

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Abstract: The rapid development of big data not only provides strong technical support for the design of streets, but also puts forward a new design method - intelligent street design. This paper explores four stages of street progress in the world: contemporary urban street innovation, Street integrity activities, Street vitality activities and intelligent street activities. It is proposed that intelligent street design will occupy a place in the future development prospects of street design on the basis of virtual skills such as big data and cloud computing. This paper discusses the application of big data in the whole process of intelligent street design on the basis of four stages of current collection, technology research, mass participation and utilization management. On this basis, it establishes a big data ecosphere of intelligent street design and conceives the future of intelligent street design.

1. Introduction

Allen said, “The magnificent streets make the city magnificent. If we can turn the streets into beautiful and satisfying ones and make everyone curious about them, we can design a third of a city perfectly and have a strong impact on the outside areas. With the development of science and technology, street design is in the classical state, taking motor vehicles as the main leader and accurately skilled street design standards, and gradually making the street suiTable for living and interactive creative design progress. Some cities have already started from the reality of rediscovering the value of street space, put forward different kinds of “street design guidelines”, once again defined the meaning and application method of street design, and triggered the upsurge of re-development of street, which is the common space with abundant potential of city. Big data is in charge of this era, and new experiments and research are provided by street design. A large number of street data have changed the classical street design. At this moment, information collection will be scattered and static data will be restrained. For example, dynamic and punctual data sources such as spatial positioning skills data and online data will be supplied to the planning and design personnel. Such data itself is usually provided by the direct users of different streets, but also from their willingness to supply. Here you are. Big data supports the same time when the data collection and research methods of street design are various, and it also brings innovation to the whole process of street design. It takes the early investigation of design to the scheme design as the basis. The second step is to examine the innovation of the whole process from various levels and angles. This kind of change from data skills to social participation can not only avoid the situation of isolated island operation caused by vertical design system, but also create a feedback system of street design in motion state and a platform for mass participation, which promotes the mode of street exchange design.

2. Development Experience of Street Design

Based on the development background, design methods, data characteristics and processing methods, this paper concludes four stages of street design in the world: modern urban street reform, complete street movement, vigorous Street movement and intelligent street movement.

2.1 Street Reform in Modern Cities

The world's first street design was due to the environmental pollution and poor management of

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urban streets in the early years of industrial innovation, such as those in Victorian Britain: dirty garbage, horse manure everywhere, noisy people and the problem that sidewalks were not set up[1]. This Street renovation centers on solving the problems of rapid industrialization and the balance of traffic facilities and street space and the standardization of devices in the process of urbanization. Bicycle organizations and clubs first proposed Street standardization to deal with the trend of cycling caused by bicycle skills. In 1875, Britain enacted the Public Health Act, which was the founding decree. Design rules for non-congestion, straightway, street paving[2].

2.2 Complete Street Movement

In the 100 years after the reform of modern urban streets, well-equipped avenues appeared in the west. The goal of the campaign is to innovate transportation policies to suit all urban users and to move cities steadily and comfortably[3]. The complete street movement embodies the idea of continuously improving the city's habitability and sustainable development. All users are encouraged to participate in street space design, including data collection, personnel training, fund creation and policy determination plans. For example, the American Federation of Complete Highways was founded in 2005, and the movement of the city spread rapidly in the United States. By 2011, 23 states in the United States will introduce policies or laws to support all urban movements. For example, California will enact the California Complete Avenue Act in 2008[4].

2.3 Vigorous Street Movement

The vivid urban movement developed through the perfect urban movement regards urban space as the mass space of the city, reduces the degree of urban environmental pollution by various methods, improves the economic activity and social joint efforts, and finally makes the city proud. Vigorous road campaign highlights the construction of places, combined with original and background road design, highlights the design process of multi-sectoral cooperation, and finally allows communities to participate in the garrison. Taking different directions into consideration, the Vigorous Street Movement uses William's and Jacobs'experience in street design and norm-setting respectively, and at the same time makes the whole street movement full of connotations[5].

2.4 Smart Street Movement

Big data provides technical support for the creation of intelligent streets. Intelligent Street is a model of a small intelligent city. It cooperates with excellent cloud computing, mobile Internet and other skills, Internet of Things perception devices and basic network as basic devices. It interacts with urban users to enhance the process of urban intelligence, create high-end basic devices, efficient regulatory services, environmental wisdom and the future. This is a new city with distinctive features. Here, through transparent, adequate information, a large number of smooth communication, efficient, intelligent information processing, effectively improve the efficiency of urban design and management, improve the quality of service. Let city users enjoy the service of intelligent highway. Through big data technology, we can consciously perceive the needs of urban users, and finally let urban users enjoy an active, intelligent and kind urban environment[6].

3. Application Stage of Two Big Data in Intelligent Street Design

3.1 Current Situation Collection Phase of Street Design

In the early stage of street design data collection, large data changed from traditional limited data, empirical judgment and statistical analysis to ocean volume data, accurate analysis and dynamic tracking. Using big data technology, using different data sources according to different design characteristics, adopting appropriate acquisition methods, preprocessing data, and finally storing data later, we will establish the basis to establish a design that meets the characteristics and requirements of each design object[7]. The current situation of intelligent highway design data acquisition mainly includes the following five aspects. One-line data includes mobile data provided by mobile devices, travel time, travel routes, travel purposes and travel methods. The data of the two urban activities include the activity pattern of street users, space-time behavior pattern, activity

type, activity density and activity time, etc. Vehicle data includes vehicle flow, parking status, user's personal information, commuting mode and driving speed. 4 Non-automobile data include non-automobile traffic, use time, user personal information and travel speed. 5. The spatial and landscape data of Expressway include types, quantities, sizes, uses and user information of various elements. For example. In data acquisition methods, compared with traditional data acquisition methods, such as random sampling and manual observation, innovative intelligent highway design-related methods, such as system log acquisition, network data acquisition, the use of specific system interfaces can collect data, provide fast, accurate and real-time information about the city, and provide a reliable basis for data extraction, conversion and storage[8].

3.2 Technical Analysis Stage of Street Design

Data analysis principles and large data analysis methods in classical highway design are characterized by research scope, analysis process and parallel implementation. Large data analysis technology applies semi-structured and unstructured data collected in urban design to data analysis, expands the scope of data analysis, and provides a broad vision for urban designers. These data extensions are created in the non-classical relational data model, and although real-time analysis and processing can be completed, the new software can complete hardware and cheap parallel display. In the early stage of urban design, big data technology can be used to fully analyze and discover the collected data, and provide a reliable basis for the establishment of design strategies. Based on the detailed definition of urban design problems, we select available data, create mining algorithms and models, and use visual software to visualize the analysis results. In this paper, data analysis and data mining are accomplished by using big data technology, taking the mobility and activity analysis of automobile and urban users as an example[9].

3.2.1 Human mobility analysis

In human flow analysis, the change of spatial position with time is the most outgoing response. The classical data survey mainly ignores the spatial effects of the moving process between two adjacent times and the spatial position of itself and the mode of reflective activity when recording data. In the process of actual operation, data recording is reflected in the creation of traffic flow in road traffic network. Big data technology integrates these data, and through the creation of models, decides which design scheme is most suiTable for different variables: urban activity prediction, characteristics and structure, etc.

3.2.2 Motor Vehicle Analysis

In the discussion based on collecting traffic information data by automatic guidance equipment, general data sources include road sensor, vehicle GPS and mobile phone base station network. By data aggregation, it integrates personal attribute data, supplements classical traffic information data, simulates traffic flow, understands traffic behavior and mode, and provides a powerful method for planning traffic network. For example, vehicle GPS trajectory data are used to analyze the characteristics of time, velocity and spatial distribution of trajectory points, determine appropriate thresholds, and filter point clusters to generate OD points. On this basis, we capture the part which includes the topological relationship at the trajectory point, and the shortest path algorithm generates linear trajectory along the road, and finally generates complete mobile channel data. Compared with the classical traffic survey data, this method has fewer data and objectively reliable results.

3.2.3 Analysis of Travel Activities of Street Users

In the discussion of urban user mobility, we can simulate the user's mobile activities by cutting off different kinds of timing data. Time intervals and personal travel speeds allow you to make traffic choices. By discussing different moving goals (such as commuting time and leisure time), you can prioritize traffic modes and evaluate different road transport. The idea and quality of the plan, the improvement of the traffic condition and the traffic environment of the residents. For example, mobile phones are used as traffic detectors to analyze residents'mobile information. The

first step is to map mobile phone data to traffic analysis unit, and through information preprocessing, matching analysis, traffic model analysis and processing, data denoising, sample expansion and so on. The characteristic data of motion are obtained. Using long-term historical moving data, commuting characteristics, OD of large cross-section and driving characteristics of specific areas can be analyzed. Mobile phone signal data can be applied to more comprehensive identification of the trajectory of the user's mobile phone, further dynamic allocation of time and space, traffic flow in key channels, driving fatigue, driving distance and driving intensity. It can be applied to analysis.Figure 1 is a sketch of the Boston Interactive Web site.

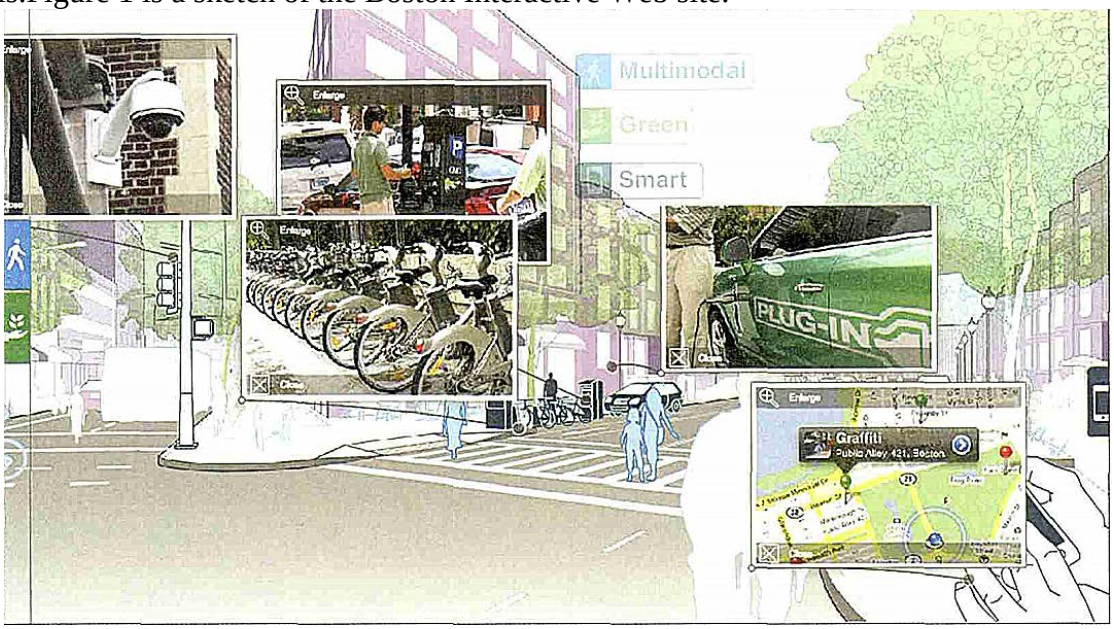

Fig.1 Boston Interactive Website

4. Conclusion

After the emergence of big data, influenced by cloud computing and virtual technology, urban design is changing from a vibrant city to a smart city. Under the function of large amount of data, accurate analysis, public participation and real-time evaluation, intelligent city design characterized by “diversity, dynamic and participatory” explores the use of large data in the whole process. We try to embody these effects in four main aspects. Starting from the detailed definition of road design problems, we select available data, use algorithms and models, and use visual software to visualize the analysis results. (3) In terms of public participation, we will change from passive information providers to information providers, and participate in the whole process of urban design as much as possible. The design of interactive city website allows citizens to download, upload and restructure their public policies in real time. Based on real-time reflection of citizens'daily life needs and suggestions, this paper is a big data ecosphere of intelligent street design: 1. multi-dimensional data acquisition and processing; 2. analysis and purification of highway data by planners and data analysts; 3. data analysis platform and data development Establish maintenance platform, submit highway data analysis report, provide four kinds of analysis structure and products for different users. In the information society of information explosion, big data provides new ideas for the new exploration of knowledge-based city design, such as urban design and data source access to heterosexual data management, effective data representation and data privacy. It must be fully recognized. In this context, how can you effectively convey the results of big data analysis and obtain effective support for design strategy formulation? Big data is the primary challenge for smart road design. For example, how do people in cities move in different time zones? How can I use the traffic I already know to teach people to move? How do you detect problems in road system design from vehicle flow and traffic flow and instruct design improvements? Such issues need to be considered.

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