Discussion on the Application of Computer Network in Intelligent City

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Abstract. Promoting the construction of intelligent city is a recognized viewpoint at home and abroad at present. Speeding up the construction of intelligent city is an effective grasp to further promote the governance of intelligent city in China and enhance the efficiency of government management. It is also an inevitable choice to innovate and optimize social and economic management, improve people's livelihood public services, optimize modern industrial structure and promote economic structural transformation. A street lamp control system based on computer network is designed to analyze the application prospect of computer network technology in the future development of intelligent city. The system meets the basic requirements of 0.3 S and 80% in data transmission rate and success rate, respectively.

Keywords: Smart City; Computer Network; Street Lamp Control System; Information Development

1. Introduction

Policies at all levels promote the development of intelligent cities and point out the direction for the development of intelligent cities. The 19th National Congress of the Party made new decision-making arrangements and placed the requirements for establishing and innovating the socialist governance system with Chinese characteristics at the historic height of the overall strategy for the economic and social development of the Party and the state. Fast people's livelihood service is a major issue facing the current urban development, which needs to be solved by new methods, new means and new technology, and the rise of the concept of urban intelligent construction, through the construction of intelligent city to solve the urban information management, residents information service, is undoubtedly a new choice for urban development[1].

During recent years, China has deployed and implemented major development strategies such as accelerating the innovation-driven development of the national information network era, the information-based manufacturing power in the network era, and the "Internet ", etc. The concept of information-based development has been gradually by the people[2]. With the release of the strategic plan and implementation outline for the development of the 13th Five-Year Plan of the central and local countries, the relevant policies and strategic directions for speeding up the construction of a new modern intelligent city will make it clearer that the network economy has become a national strategy. Not only drive economic growth, but also help social governance innovation. At present, the country has regarded the construction of intelligent city and the development of computer network economy as
the basic strategic development resources of the country, and will speed up and promote the sharing and opening of intelligent city network and resources, develop network applications, and speed up the transformation and upgrading of computer network industry as an effective means to promote economic and social governance innovation. In recent years, computer networks and smart economies are booming, The total revenue of the information network industry in 2018 has reached 25.8 billion yuan, And in the past 8 years to maintain a continuous rapid improvement [3]. In addition, The value of information networks has been constantly exploited and applied, such as enterprise precision marketing, people's livelihood network services, government network applications, Both will provide strong technical and network support for the construction and development of intelligent cities in China. First put forward a series of intelligent city research ideas, from the American international webinar in 1990, Thereafter, The contents of the conference are published in the form of documents, and became the early wisdom city research work literature; And Malaysia passed the Multimedia Super Corridor program in 1995, Show the world the vision of building a smart city. Since then, This idea began to spread around the world. For foreign scholars, the connotation of intelligent city is the product of the integration of information technology and urban development, it is also the government's changing governance model, A means of improving management effectiveness. Overall, foreign research and construction of smart cities, it mainly grasps the four core points: insisting on the government leading as the core, adhering to the people-oriented core, adhering to the typical driving core, and adhering to the reality as the core, and provides a good enlightening for domestic research[4].

With the increasing dependence of people's production and life on computer network, whether the computer network can run reliably has gradually become a problem of management and user concern. Based on the global potential risk of computer network, this paper makes full use of operational research and system reliability theory, and establishes the corresponding mathematical model. Intelligent city is the main goal of serving the whole process of people, the high efficiency of urban governance and the convenience of data opening. Through the development and service of information close to urban management, people's livelihood service and administration management, it can give full play to its better intelligent service ability. Its essence is the embodiment of serving the people wholeheartedly. Through the application of computer network in intelligent city, this paper analyzes the present situation and prospect of intelligent city development.

2. Basic Concepts and Definitions

2.1. Smart Cities
Wisdom city is through close to the city management, people's livelihood service, administration information development and service, let it play a better intelligent service ability, its essence is to serve the people wholeheartedly. The research on the concept of intelligent city by Chinese scholars mainly includes four aspects: first, based on the technical point of view, it is believed that the intelligent city is based on information technology and through the implementation of cash technology. To provide better quality services and guarantees for social governance. For example, Li Deren believes that the intelligent city is a deep integration of the Internet of things, cloud computing, big data and other emerging technologies; second, based on the perspective of urban development, the wisdom city is a new concept of urban construction, so that the people have a better life experience; third, based on the perspective of systematic engineering, the wisdom city is a comprehensive systematic project, through the integration of the system between the development, mutual support and formation of social development form [5].

The development of intelligent city is an important symbol of urban economic transformation and upgrading, and a new stage of better development of information development index compared with traditional interconnected cities. The intelligent city takes the mobile Internet, the information technology application, the virtual reality physics technology and so on as the main characteristic, transforms the virtual reality physical world information into the city virtual reality physical state
which uses the Internet and the mobile information technology fusion. From the traditional interconnected city to the stage of intelligent city, it emphasizes that with the help of advanced information technology, the key information of society can be measured, obtained, analyzed and output more efficiently, and finally forms the intelligent support for e-government, public relations service and people's livelihood service. Building and developing intelligent cities is not only to speed up the further exploration and research on the forms, stages and models of public life in human economy and society, but also to effectively deal with and solve all kinds of challenges and problems that may arise in the construction and development of human intelligent cities.

The construction of intelligent city system involves a wide range, many contents and large system. At present, it is still developing and completing, and has not yet formed a unified concept and standard. Intelligent city is the collection of intelligent application of information data in various fields, from the personal health information of the residents with the smallest granularity to the macro information of the whole city's social and economic operation. The original intention of intelligent application is to grasp the key points of urban management, form characteristics, find blind spots and solve pain points. Second, linear series, emphasis on integration. Intelligent city through a variety of ubiquitous, high-speed urban information communication and integration network, urban individuals, enterprises, government and other multi-divided resources and information for linear links. Third, comprehensive coverage to promote information integration. Intelligent city informatization is the concrete realization of the national implementation of the information strategy of urban economic and social development, covering the whole intelligent city management and information, as well as infrastructure, investment and financing and other fields, through the intelligent city application of advanced urban information big data analysis technology, in-depth analysis of the information and data collected, timely and accurate grasp and reflect the situation of urban economic and social development and economic operation, and promote the urban information development strategy organically integrated, help urban managers adapt to local conditions, scientific decision-making [7].

2.2. Smart City Construction

Smart city in our country, Has experienced the embryonic stage and the landing stage successively. You can say, The year 2010 is the important time point of our country wisdom city construction, Until then, The promotion of various work belongs to the embryonic stage. And after 2010, Some cities in the country are starting to be driven by local governments, Initiate research on smart city construction, Specific action plans and implementation strategies have been developed, And bring it into the city's 12th Five-Year Plan, Other cities followed suit. By the end of 2018, China has more than 800 cities to carry out intelligent city work pilot [8]. Domestic scholars on the construction of intelligent cities in China, It mainly includes two aspects: first, the research on the construction path. On behalf of Wang Lu, To study the construction of intelligent city in China, It provides a theoretical basis. Second, the implementation of the status quo analysis. Like, By comparing the current construction situation and stage effect of 28 smart cities in China, also includes to our country wisdom city construction existence some concrete question inquiry, found in the construction process, Talent training, information security and other issues. Like, Pan Minyi found in the study, China's talent structure is unevenly distributed, and some innovative high-end guess reserves are relatively inadequate [9].

2.3. Computer Networks

Computer network is a complex network system which interconnects several computers distributed in different regions and enables them to complete specific functions. In this network, no computer can control other computers completely, and each computer has its own independence. But these computers are not unrelated and can freely access the information resources through the computer network. The communication subnet and the user resource subnet together constitute the computer network, the former is responsible for the information transmission between computers, the latter is responsible for processing the resource information and providing it to the computer network. Image, computer network is to build a bridge between independent computers, so that they can freely
exchange information [10].

2.4. Computer Network Algorithm
(1) State enumeration

\[ R_s = \sum_{i=1}^{m} P(B_i) \]  

(2) Rate of data signalling

\[ R = \frac{1}{T \log_2} \text{bps} \]  

(3) Signal transmission rate

\[ B = \frac{1}{T} \text{Baud} \]  

(4) Relationship between Modulation Rate and Data Transmission Rate

\[ R = B \times \log_2 N \text{bps} \]  

3. Application of Intelligent Street Lamp Control in Smart City

3.1. Functional and Performance Requirements Analysis

The intelligent city street lamp remote control system should realize the intelligent control and management of street lamp from three aspects: one is to control the brightness of street lamp on/off reasonably; the other is to manage the street lamp system synthetically, which is divided into the management functions of street lamp information collection management, data management, parameter management, system management, etc. Taking the above three aspects as the starting point, the intelligent city street lamp remote control system designed in this paper should have the following functions:

1. It shall have the function of controlling the street lamp switch and adjusting the brightness and energy saving of the street lamp as required;
2. It should have the function of collecting relevant information of street lamp and distribution station area and recording relevant events of street lamp;
3. Management of the main station, intelligent terminal, street lamp controller and other equipment;
4. Should have data storage, data management, remote monitoring, fault alarm, geographic information management and other management functions;
5. Should have leakage detection, branch current detection and other functions.

In order to ensure the whole safe and stable operation of the system, the performance requirements and basic principles of the intelligent city street lamp remote control system designed in this paper are as follows:

1. In order to save electricity, the system should reasonably control the time and brightness of the street lamp on/off;
2. In order to provide good traffic conditions for traffic and pedestrians, the system should be of high reliability;
3. In order to facilitate the management and control of street lamps by municipal authorities, the system should have a high level of control.

3.2. System Design

The system is composed of intelligent terminal, communication network and street lamp group of
street lamp flexible control on the remote control platform of Internet of things.

The Internet of things remote control platform layer includes network terminal equipment, computer workstation and special control software. It mainly completes geographic information management, panoramic perception and online analysis of power flow information in street lamp distribution area, operation state and information remote optimization of street lamp group itself, security control.

The intelligent terminal and equipment layer of street lamp flexible control includes intelligent terminal of street lamp management, environment and general auxiliary intelligent terminal, intelligent terminal of street lamp single wireless control, equipment of intelligent flexible distribution station area of street lamp (box type substation), etc. It mainly completes intelligent integrated control of street lamp, safe and efficient distribution and supply of electric energy.

4. Analysis of Test Results of Computer Network in Smart City

4.1. Lamp Brightness Control Test

Table 1. Test Chart of Street Lamp Input Current Under Different Duty Cycle

| Duty cycle | 0% | 10% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | 90% | 100% |
|------------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Street lamp input current (A) | 0.261 | 0.326 | 0.532 | 0.801 | 1.064 | 1.328 | 1.595 | 1.861 | 2.125 | 2.392 | 2.655 |

Brightness adjustment refers to the brightness adjustment of street lamp through control system. The experimental object is three dimmable LED street lamps. The dimming principle of LED street lamp is to adjust the input current of LED street lamp to realize dimming. The content of the test is to send out the wireless dimming control command through the computer background. After receiving the dimming command, the intelligent terminal of the single wireless control of the street lamp will output the PWM signal of different duty cycle to the LED street lamp, thus adjusting the brightness of the street lamp from 0 to change. After testing, brightness adjustment can be fully realized. A multimeter records the input current of the LED street lamp under different duty cycle. The actual data are shown in Table 1.

4.2. Test of Electrical Parameters Uploaded by Intelligent Terminal for Single Wireless Control of Street Lamp

Table 2. Data Table of 10 Consecutive Uploads

| Frequency | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Mean value |
|-----------|---|---|---|---|---|---|---|---|---|----|------------|
| Voltage Electric current | 218.5 | 218.3 | 219.2 | 219.2 | 218.7 | 218.5 | 218.8 | 219.1 | 219.4 | 218.2 | 218.79 |
| Active power | 0.377 | 0.375 | 0.377 | 0.376 | 0.376 | 0.375 | 0.376 | 0.375 | 0.374 | 0.373 | 0.3754 |
| Power | 82.3 | 81.8 | 82.6 | 82.4 | 82.2 | 81.9 | 82.2 | 82.1 | 82.0 | 81.3 | 82.08 |
| Power factor | 0.994 | 0.995 | 0.994 | 0.995 | 0.993 | 0.998 | 0.995 | 0.998 | 0.994 | 0.995 | 0.9951 |

In this paper, the electric energy meter with the accuracy of 0.5 grade is used as the standard to meet the measurement accuracy of this experiment. Within the same time period, the actual power of 100 W LED street lamp is 96 under the condition of 100% brightness W, and the intelligent terminal of KD-24 and street lamp single wireless control is used to collect the electric parameters on the street lamp. Table 5-2 records the voltage, current, active power, power factor and mean values that are continuously uploaded 10 times every two minutes.

4.3. Data Transmission Success Rate Test
Figure 1. Platform Transmission Success Rate Test

According to figure 1, in the data transmission success rate test project of the platform, after three rounds of testing, each test time is one minute, the transmission success rate basically meets the demand of more than 80%.

4.4. Data Transmission Rate

As shown in figure 2, the transmission rate tends to stabilize with the increase of time. Through three tests, it is found that the rate is basically stable at about 0.17 S, which meets the basic requirements of less than 0.3 seconds.
5. Conclusions
By integrating and making full use of new technological means, such as electronic information and mobile Internet, to promote the continuous innovation of the concept of economic and social services, the continuous strengthening of the quality and ability of people's livelihood services, the continuous improvement of people's quality of life and experience, and the construction and support of an intelligent and comprehensive urban Internet and economic and social service system that drives and leads the economic and social innovation and industrial optimization and upgrading. This paper mainly expounds the related concepts of intelligent urban development and the concept of computer network, and constructs a street lamp control system based on computer network. Through testing and analysis, the control system is at the rate, The success rate and error meet the needs of intelligent city construction, and the development prospect of computer network in the application of intelligent city is broad.

References
[1] Shelton T , Zook M , Wiig A . The 'actually existing smart city'[J]. Social Science Electronic Publishing, 2015, 8(1):13-25.
[2] Hashem I A T , Chang V , Anuar N B , et al. The role of big data in smart city[J]. International Journal of Information Management, 2016, 36(5):748-758.
[3] Wang T , Bhuiyan M Z A , Wang G , et al. Big Data Reduction for a Smart City's Critical Infrastructural Health Monitoring[J]. IEEE Communications Magazine, 2018, 56(3):128-133.
[4] Li Y , Dai W , Ming Z , et al. Privacy Protection for Preventing Data Over-Collection in Smart City[J]. IEEE Transactions on Computers, 2016, 65(5):1339-1350.
[5] Ayona, Datta. New urban utopias of postcolonial India: 'Entrepreneurial urbanization' in Dholera smart city, Gujarat[J]. Dialogues in Human Geography, 2015, 5(1):3-22.
[6] Chang C I , Lo C C . Planning and Implementing a Smart City in Taiwan[J]. IT Professional, 2016, 18(4):42-49.
[7] Mandal A , Byrd H . Density, energy and metabolism of a proposed smart city[J]. Journal of Contemporary Urban Affairs (JCUA), 2017, 1(12):57-60.
[8] Hongbo S , Sang-Bing T , Xiaowei L , et al. How to Evaluate Smart Cities' Construction? A Comparison of Chinese Smart City Evaluation Methods Based on PSF[J]. Sustainability, 2017, 10(2):37-38.
[9] Niaros V , Kostakis V , Drechsler W . Making (in) the smart city: The emergence of makerspaces[J]. Telematics and Informatics, 2017, 34(7):1143-1152.
[10] Jones, L. Securing the Smart City[J]. Engineering & Technology, 2016, 11(5):30-33.