

Based on Big Data LED Smart Street Lighting System

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Abstract

In the LED smart street lighting system based on big data, Zig Bee and GPRS technologies are used for data transmission, and the big data related technologies such as data acquisition, data storage, data cleaning, data mining, and data visualization are applied to the system. The large amounts of data the LED smart street lamp terminal sensors collected are analyzed and processed. Through the data processing results, the street lights are intelligently controlled and corresponding management strategies are implemented for the urban environment and traffic conditions. In addition, through the official account platform for city smart street lights, aiming the users who are concerned about the account managers can collect and analyze data to offer residents more convenience.

Keywords

Big data; Smart street lights; Zigbee; Official account platform.

1. Introduction

The wide application of computer technology and the expansion of the field have made the development of various industries in society constantly improve and made great contributions to the progress of society. The concept of "smart city" has brought us into another new field of computer technology application and accelerated the process of socialist modernization. Among them, in order to increase the convenience of urban residents and reduce the workload of urban supervisors, the emergence of intelligent street lamps has greatly increased the intelligence of the city and improved the city's self-management ability. At the same time, China has always advocated "green environmental protection, energy saving and emission reduction, and sustainable development". Traditional street lamps have serious problems such as energy waste, single function and difficult fault detection. Therefore, the function of intelligent street lamps not only meets the daily life and work needs of urban residents and supervisors, but also solves the problem of energy conservation and emission reduction in cities and promotes the sustainable development of energy.

2. Big Data Technology

Big data is massive data, which refers to a collection of data that cannot be captured, managed, and processed by conventional software tools within a certain time frame. It is a massive amount of decision-making, insight, and process optimization capabilities that require new processing models. High growth rates and diverse information assets. Thus, in order to process massive amounts of data, big data technologies have emerged, which mainly include massively parallel processing (MPP) databases, data mining, distributed file systems, distributed databases, cloud computing platforms, the Internet, and scalable storage systems. Big data technology is divided into five core parts, namely data collection, data storage, data cleaning, data mining, and data visualization.

3. System Design

The intelligent street lighting system consists of four parts: street light switch and brightness control, environmental quality monitoring, intelligent data analysis platform and public number management platform. The system function structure diagram is shown in Figure 1.

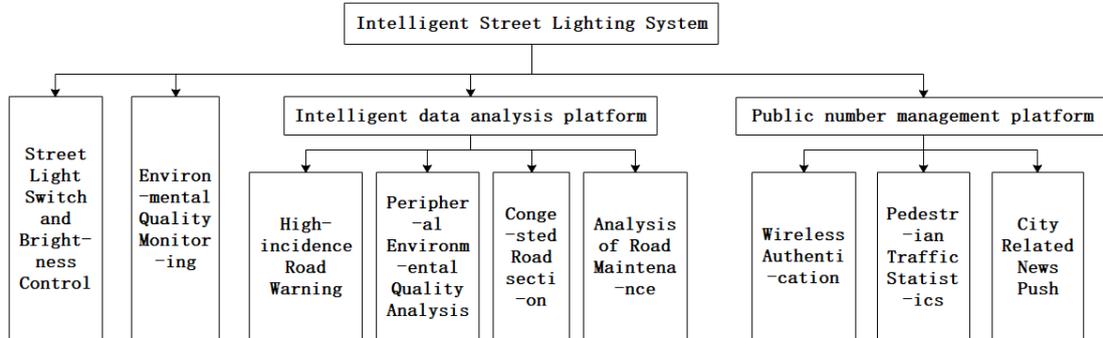


Figure 1. System function structure

3.1 Street Light Control and Environmental Monitoring

The street light switch and brightness control are composed of three parts: street lamp terminal sensor, centralized controller and monitoring platform. The light sensor and the temperature sensor are installed at the street lamp terminal, and the data is collected by the sensor and sent to the centralized controller through Zig Bee technology, and then communicated with the monitoring platform through the GPRS network, and the monitoring platform switches and brightness of the street lamp according to the transmitted data. Carry out intelligent regulation to achieve the effect of energy saving and emission reduction.

The environmental quality monitoring mainly installs the ZE12 type atmospheric environment monitoring sensor at the street lamp terminal, and uses the electrochemical principle to detect the CO, SO₂, NO₂, O₃ and other gases present in the air, and has good selectivity and stability. The implementation of this function also uses the GPRS network for data transmission.

The functional framework diagram described above is shown in Figure 2.

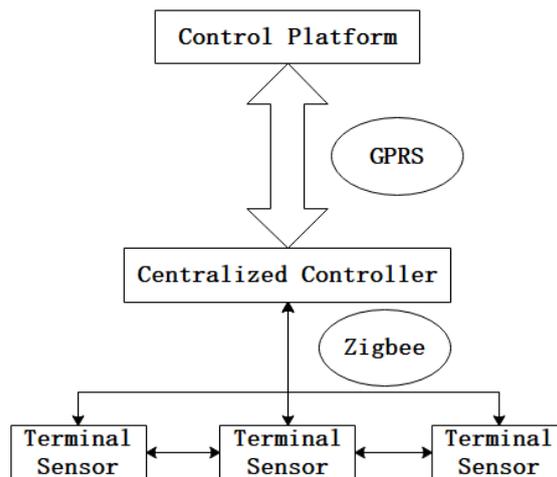


Figure 2. Functional framework

3.2 Intelligent Data Analysis

For the traffic flow of a certain section, a video-based traffic flow statistical algorithm is used to judge whether there is a vehicle passing through the state change of the relative position state variable and the pixel value state variable of the virtual detection line and the vehicle, at every other distance. On the street lamp, a double virtual detection line is set for traffic flow statistics. When two detection lines simultaneously determine that a vehicle passes, the traffic flow count of the road section is

incremented by one, and the flow chart is shown in FIG. According to the collected traffic data, the data is imported into the software tool KNIME for data mining to obtain the field information of the road section where the intelligent street lamp is located, so that the supervisors can make more effective solutions in time. The specific related functions are as follows:

- (1) A section showing a high probability of a traffic accident. When the traffic volume of a certain section is too large, through the analysis and processing of the data, the information of the road section with high traffic accidents is obtained, and the supervisors are reminded to pay attention to them at all times. At the same time, it is also possible to retrieve the video surveillance of the road section in real time, check the situation on the ground, and dispatch the staff to solve the traffic accident on the spot in light of the actual situation.
- (2) Regulate the street light switch and brightness. When it is detected that the traffic volume of a certain section is small during a certain period of time, the brightness of the street lamp can be appropriately lowered, and the method of opening and closing the street lamp is implemented to save energy and reduce emissions for the city.
- (3) Analyze the environmental quality around the intelligent street lamps and provide advice on governance. In the road with large traffic volume, the vehicle exhaust emissions are large, posing a threat to the surrounding environment. In such a road section, the greening area can be increased, the water can be sprinkled, the dust particles in the air can be reduced, the environment can be improved, and the comfortable urban environment can be provided for the residents.
- (4) Full control of urban traffic and solve the traffic congestion of vehicles. When there is a phenomenon of vehicle congestion in the city, the intelligent street lamp management system can find out the dredging method in time, that is, to clear the road section with small traffic flow, provide a suitable roadway for the traffic police, realize traffic smoothness, and decompress the road section with large traffic volume. .
- (5) Detecting the condition of road maintenance. In the road with large traffic volume, the road is seriously damaged. Through the intelligent street lamp management system, the supervisors can be regularly reminded to overhaul the road.

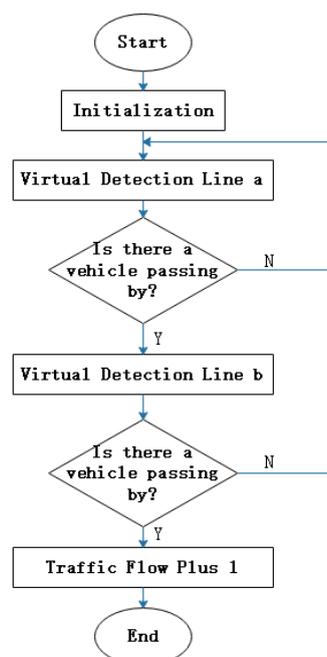


Figure 3. Traffic statistics flow chart

3.3 Statistics and Analysis of Public Number Platform Data

The staff of the supervision center apply for a public number on the WeChat public number platform and manage it in the background. The public number QR code is displayed on the street light pole,

and the pedestrian can scan the two-dimensional code to pay attention to the public number. The intelligent street light management system collects data by paying attention to the personnel.

(1) Wi-Fi Internet access. After paying attention to the public number, it can realize authentication online, improve the city's Internet coverage, and solve people's outdoor Internet problems.

(2) Statistics on smartphone usage. Through the number of people of the public number and its growth trend, analyze the popularity of smartphones and the impact on people's lives.

(3) Count the pedestrian traffic of the road section through the Wi-Fi connection of a certain section. For the road sections with large pedestrian traffic, strengthen the video surveillance of supervisors, carry out strict control, prevent the occurrence of criminal acts such as pickpockets and robbery, and guarantee the safety of people's lives and property.

(4) Send a push message through the public number platform. For example: lost and found, emergency notice, urban weather, life survey, real-time road conditions, residents' activities, etc., to facilitate the life of urban residents while enriching leisure activities.

4. Conclusion

In this paper, the intelligent street lighting system is analyzed, and the functional requirements of the research of intelligent street lamps under the big data information processing technology are analyzed. The traditional street lighting system is energy-savingly modified, and various sensors, controllers and communication modules are installed on the street lamps. The use of big data technology can easily and effectively regulate the area where the intelligent street lamp is located, adapt to the development trend of the big data era, and promote the development process of the smart city.

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