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Research on the feasibility of smart street lamps based on the 5G era

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Abstract: *With the advent of the 5G era, the highly developed communication and information processing technology, and the further maturity of the Internet of Things application technology, how to build a smart city, how to make full use of new technologies and new methods to create a smart, high-quality city Current hot topics. In order to achieve the demand for smart street lights, the paper proposes to use 5G technology to cooperate with installation to quickly transmit detection and response information, establish base stations, and complete security detection, environmental monitoring, LED headlight self-adjustment based on Internet of Things technology, and DSRC vehicle-road smart collaboration The system relieves traffic pressure, the Internet of Things relays intelligently predict road conditions, reports SOC dangers, and installs charging piles. After reasonable assembly, construction and testing, efficient and intelligent functions are realized.*

Keywords: *5G, Internet of Things technology, smart city, DSRC vehicle-road smart collaboration, SOC*

1. Introduction

The promotion of 5G networks and the Internet of Things is an opportunity for the development of smart street lights. The small size of 5G base stations, easy installation and low energy consumption, can effectively save urban land and save costs. Smart street lights are an indispensable part of today's society, cities and rural areas. This article uses 5G base station-based signal transmission, timely feedback of detection signals, intelligent adjustment of lighting lights, auxiliary traffic, and installation of charging piles. It clearly explains its modern urban development and rural development. Provide a basis, realize smart cost saving, and provide a basis for the city.

2. Construction of smart street lamp system

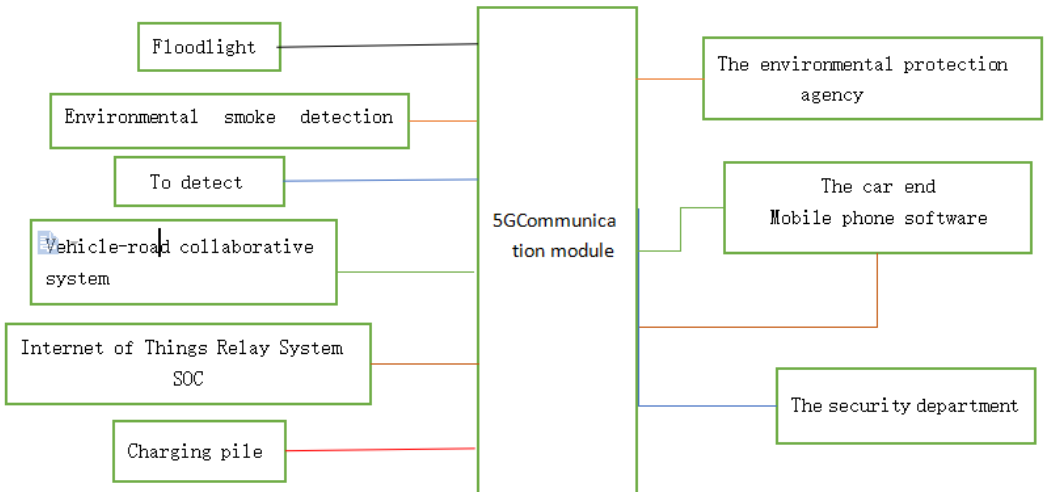

Figure 1 System construction diagram

This street lamp system is mainly integrated into the single function of traditional street lamps, and is upgraded with advanced technologies such as integrated 5G and Internet of Things. Street lamps are installed with environmental smoke detection sensors, monitoring terminals, DSRC vehicle-road

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coordination systems, Internet of Things relay systems, SOC; Data collection, transmission, analysis and storage are completed under the integration of 5G communication terminal. In terms of remote communication, it is based on 5G technology and base station construction. The network communication module under 5G technology cooperates with Ethernet for data transmission, using TCP/IP communication protocol. The control system analyzes and stores the data, and the remote control center uses the same 5G technology to quickly distribute the stored data to various departments. The module executes instructions for its related data and transmits it to the previously set street lamp targets for positioning processing. The detection software on the mobile phone obtains the data through the 5G/4G local area network, and the remote data control system analyzes and stores it. Figure 1 shows the data transmission diagram of the system setup.

3. System hardware configuration

3.1 DSRC vehicle-road coordination system

It is a short-range wireless communication that realizes real-time interaction of vehicle-to-vehicle, vehicle-to-road dynamic information in all directions, and realizes active vehicle safety control and road collaborative management based on traffic information collection and integration, ensuring traffic safety and improving traffic Efficiency, thereby achieving road traffic safety coordination and promoting the development and construction of smart and civilized cities. The development of Internet of Vehicles and unmanned driving technology brings important development opportunities for vehicle-road collaboration technology. The relationship between road conditions and vehicle conditions can better realize unmanned driving, road danger warning, emergency braking, etc., through the cloud The development of computing, big data, and mobile Internet technology has provided more reliable technical guarantees for high-precision positioning, refined information acquisition and processing, services, and the construction of a new generation of wireless sensor network 5G. As a new generation of intelligent transportation system, the vehicle-road collaboration technology fully realizes the dynamic real-time information interaction between vehicle owners and vehicle-road, completes the collection and fusion of all-time and space dynamic traffic information, processes information, fully shares information, reports road conditions in time, and timely warning processing, here On the basis of the complex road traffic environment, the safety of vehicles is realized, the active control of road traffic is realized, and the operation efficiency of the road network is improved.

3.2 IoT relay module

The information model of the Internet of Things based on the wireless relay system, which includes the physical layer, the transmission layer, the cooperative processing layer, and the perception layer and user control subsystem that perceive the physical environment. It includes the wireless relay system, which is located in the perception layer To the middle of the transmission layer, the wireless relay system includes logical units including wireless data physical layer processing unit, sensor data acquisition and conversion unit, information fusion unit, wireless data encoding, decoding, packaging unit, information synchronization processing unit, and information interaction unit The biggest advantage is that the wireless relay system, as the access gateway between the perception layer of the Internet of Things and the heterogeneous wireless communication network, facilitates the multi-level integration of information, cross-level integration and deep integration, and selectively analyzes the physical layer The information to the transport layer is used for collaborative processing or control and decision-making.

3.3 Monitoring data transmission end

Based on the smoke sensor to detect dust particles and smoke in the environment, the data is classified and transmitted to the environmental protection department to meet environmental protection requirements, which is very suitable for environmental protection and environmental monitoring in cities, suburbs, and rural areas, and achieves all-round environmental protection requirements and monitoring For portraits, vehicle conditions, road conditions, detection records, classified storage and transmission, transmission, analysis, and security records.

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3.4 Charging pile

Based on the further development of new energy vehicles, charging piles are becoming more and more important in cities. Install charging piles for street lights to further relieve urban space pressure and improve efficiency. Install in urban streets, parking lots, suburbs, and parking spaces to improve smart and efficient cities. The gap installation between pile street lamps and ordinary street lamps saves costs, improves efficiency, and exerts the greatest effect.

4. Remote communication

The long-distance communication mainly integrates 5G transmission. The DSRC vehicle-road coordination system enables motor vehicles (equipped with OBU) to pass at medium speeds (50-60 km/h). The data exchange of the edge equipment RSU, applied to ETC is the automatic charging (recording, read-only function)/management/information exchange transmission/settlement system. It is a smart hardware product with a high degree of intelligence. It is equipped with holographic perception video detection module, full-color variable information screen, smart LED lighting equipment, WIFI broadband access sniffing module, environmental detector and other smart devices. Realize the intensive management of road equipment and facilities, realize the intelligent construction or update of road intelligent facilities and equipment, and form a "people-vehicle-road-environment" intelligent network connection. Road conditions and vehicle conditions are displayed on the information screen, and can also be obtained from the vehicle or mobile phone, as shown in Figure 2.

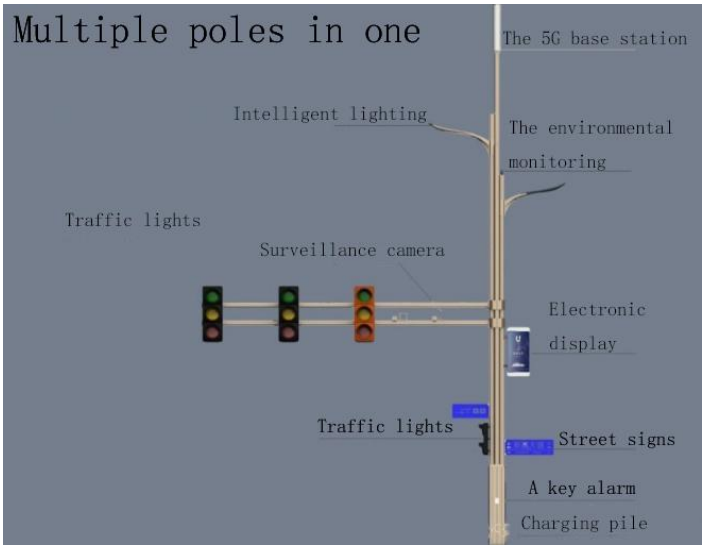

Figure 2 Street lamp structure

5. Software design

The software module is mainly based on the DSRC vehicle-road collaboration, the Internet of Things relay interconnection module, as shown in Figure 3 and The image is shown in Figure 4.

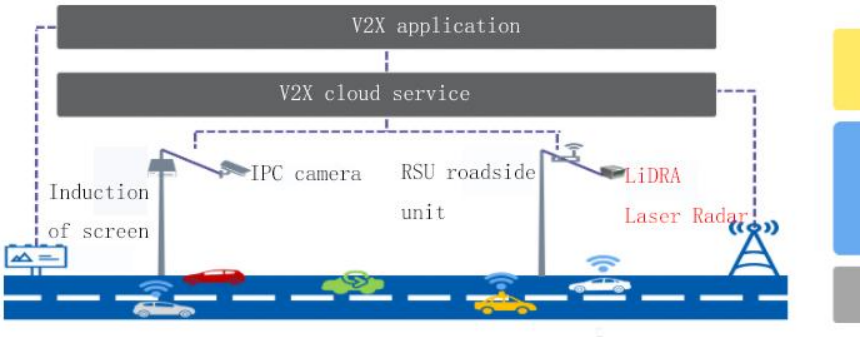

Figure 3 The car ie coordinating the data transfer

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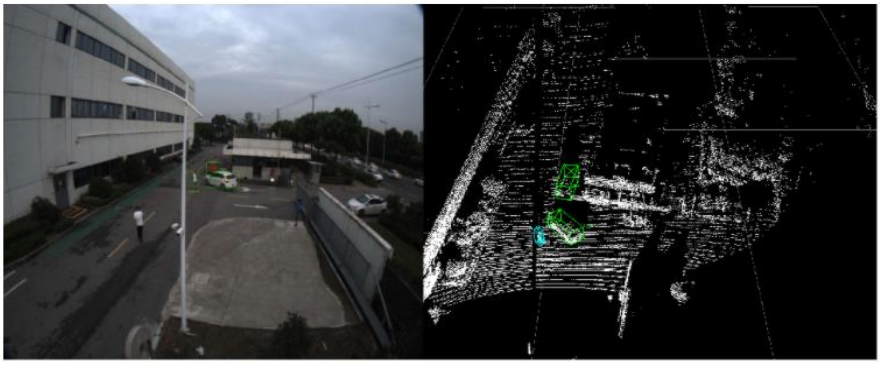

Figure 4 Monitor video presentation

Urban road safety early warning for people and vehicles, traffic violation detection, traffic flow statistics, comprehensive traffic monitoring and command management, ETC highway, trigger capture, vehicle information detection, abnormal event warning, traffic monitoring and management. The image is transmitted to the relevant module through the information transmission module through 5G network analysis and storage, and the vehicle-road collaboration module.

6. Smart street lamp system test analysis

Orderly assembly of light poles, installation of smoke and dust detection sensors, monitoring assembly, assembly of DSRC vehicle-road coordination system, Internet of Things relay system, assembly with 5G communication module, assembly of 5G base station, installation of solar panels for street lamps, ordinary work, charging pile use Buried AC power provides electrical energy, which can be used for payment by scanning the code. The SOC button is assembled as an emergency alarm. After the assembly is completed, the test runs normally. The mobile phone APP, in-vehicle, through the vehicle-road coordination system, road condition detection to obtain data, to achieve risk avoidance, congestion mitigation, the Internet of things under the powerful Internet of Things technology, the vehicle condition data is further relieved and promoted The construction of smart cities is highly feasible.

7. Pros and cons

Advantages: Provide integrated functions for environmental detection, monitoring records, vehicle conditions, road condition detection and analysis, new energy charging, emergency alarms, and further promote the quality of smart cities, powerful Internet of Things technology, to achieve vehicle-road information interconnection, traffic information interconnection and mutual knowledge , To improve people's travel convenience, 5G rapid transmission efficiency to further development.

Disadvantages: the assembly price is too expensive, commission and ordinary street lights are installed and tested separately, saving costs and improving efficiency.

8. Conclusion

Based on the smart street lights assembled in the 5G era, it can greatly alleviate urban traffic, environmental protection, and security problems. When ordinary street lights are installed alternately, they can save costs and improve efficiency, promote the development of new energy in the city, save urban space, beautify the city, and provide the ultimate for people's lives. Great convenience, which should be greatly developed in the background of smart cities and in the 5G era, providing many conveniences for people's lives.

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