Traffic Management System Design of Intelligent City Based on Narrowband Internet of Things

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Abstract. With the rapid improvement of the urban economic level in our country, the acceleration of transportation infrastructure construction, the sharp increase in urban transportation demand, the increasing contradiction between transportation supply and demand, traffic congestion, traffic pollution, frequent traffic accidents, and difficulty in parking have become a constraint on urban society. The bottleneck with economic development has become the focus of current traffic management departments. With the rapid development of network technology and the spread of NB-IoT communications in a large area, this article introduces the design of NB-IoT smart city traffic management systems in detail.

Introduction

With the continuous development of information technology, the level of urban informatization application has been continuously improved, and the construction of smart cities has emerged as the times require. With the continuous development of human society, cities will carry more and more people in the future. At present, China is in a period of accelerated urbanization, and the problem of "urban disease" in some areas is becoming increasingly serious. In order to solve the problems of urban development and achieve sustainable urban development, the construction of smart cities has become an irreversible historical trend of urban development in the world today. Building a smart city is of great significance in achieving sustainable urban development, leading the application of information technology, and improving the overall competitiveness of the city. With the continuous improvement of science and technology and the rapid development of society and economy, the scale of urban construction has become larger and larger, and transportation problems have become increasingly serious.

Xi’an, as the heart of the Asia-Europe Continental Bridge Economic Belt and an international metropolis for Asia-Europe cooperation and exchange, must shoulder the important task of a new starting point for the Silk Road Economic Belt. As a traditional strong transportation province, Shaanxi Province must be certain in the development of smart transportation. It should be in line with advanced levels in the eastern developed regions and even the world. From the perspective of promoting the transformation and upgrading of the industry, modern information technology must also be used to give full play to the functions of existing transportation infrastructure, give full play to the benefits of transportation operation management, and better serve economic and social development. Accelerating the construction of smart transportation is an important measure for building a strong transportation province.

For urban traffic problems, coordination is needed in many ways to upgrade and improve the urban transport system. From the perspective of the government, in addition to actively introducing new equipment and increasing capital investment in transportation facilities, we also need to strengthen the management of transportation facilities and promote the optimization of management systems. From the perspective of traffic management, it is necessary to actively implement advanced smart traffic management concepts and smart traffic facilities to better serve urban traffic.

Overview of NB-IoT

The construction of smart transportation is inseparable from the development of the Internet of
Things. One of the foundations for the realization of "Internet of Everything" lies in the transmission of data. Different IoT services have different requirements for data transmission capabilities and real-time performance. NB-IoT stands for "Narrowband Internet of Things Technology" and is an important branch of building the Internet of Things. There are many wireless communication technologies for the Internet of Things, which are mainly divided into two categories: one type is short-range communication technologies such as Wi-Fi and Bluetooth; the other is LPWAN (low-power Wide-Area Network) wide-area network communication technology. NB-IoT is a type of wide area network communication technology. The current 4G network is obviously powerless to connect things. Compared with short-range communication technologies such as Bluetooth and ZigBee, NB-IoT has no advantages in distance, power consumption and cost. The specific performance is as follows: (1) Wide coverage, 20dB gain and 100 times higher coverage area than the existing network in the same frequency band; (2) Low power consumption, and the standby time of NB-IoT terminal modules can be up to 10 years; (3) Low cost, can be straight

It can be connected to GSM network, UMTS network or LTE network to reduce deployment cost. [1]

### Overall System Design

The overall design of this system is divided into three levels: (1) the perception layer, which contains monitoring terminals and various sensors to monitor road condition information, traffic information, and vehicle driving information; (2) the network layer. It consists of the base station and the NB-IoT core network, and is mainly responsible for transmitting the data collected by the perception layer to the server. (3) The application layer is responsible for processing and analyzing the information transmitted from the network layer. It is concluded that this system including vehicle system and road condition system, can analyze the corresponding travel plan and road condition statistics. The overall design of the system is shown in Fig. 1.

![Overall System Design](image)

The NB-IoT base station of this system is linked based on the Socke UDP protocol. For the data transmission of the Socke UDP protocol, the user is directly encapsulated in the signaling message at the NAS layer and encrypted by encryption. The system uses the CoAP protocol for communication. The data transmission process includes UE, IOT, encoding plug-in and Server. The STM32 processor device in the perception layer first collects ultrasound, microwave information, GPS data and encodes the data according to custom rules; the code communicates with the NB-IOT module via the serial port at 115200 baud rate and AT commands, and sends Encode data to the NB-IoT module or information management platform; after receiving the NB module information, it is automatically encapsulated as a CoAP protocol message and sent to the pre-configured NB-IoT platform; after receiving the data, NB-IoT automatically Parse CoAP protocol packets [3].

### Road Network System Design

The functions of the road network system include that the vehicle information collected by ultrasound is processed by STM32, and the processed results are transmitted to the WEB server through NB-IoT; meanwhile, the image information collected by OV5640 is also processed and
transmitted to the WEB server. The data is analyzed to obtain road condition information and corresponding resource scheduling. The system frame diagram is shown in Fig. 2.

![Figure 2. Road Condition System Frame Diagram.](image)

It uses camera image data and ultrasonic data to collect vehicle data.

**Vehicle System Design**

The functions of the on-board system include the vehicle information collected by the Beidou system and the surrounding vehicle flow information collected by the microwave. The information is processed by the STM32 and passed to the telecommunications / mobile IoT platform. The collected information is used to obtain the optimal vehicle travel plan through genetic algorithms. To send to the client. The system frame diagram is shown in Fig. 3.

![Figure 3. Vehicle System Frame.](image)

**System Software Business Function Framework**

The system software functions include designing to extract traffic data and vehicle data from the sensing unit module, detect based on user terminal information, road network traffic/person flow detection, and establish signals at various levels including road network and facilities, signal control, public transportation, and shared bicycles. Optimize the model to achieve large-scale network signal optimization, break through the control problem of urban areas, and achieve better overall optimization results while improving optimization efficiency. The software business functions of this system are shown in Fig. 4.
Summary

Smart transportation is the full use of the Internet of Things, cloud computing, the Internet, artificial intelligence, automatic control, mobile Internet and other technologies in the transportation field. It collects traffic information through high and new technology, and has a full range of transportation management, transportation, and public transportation. The whole process of transportation construction management shall be controlled and supported to fully ensure traffic safety, give play to the effectiveness of transportation infrastructure, improve the operation efficiency and management level of the transportation system, and serve smooth public travel and sustainable economic development. The main characteristics of the narrowband IoT communication technology make long distance, low energy consumption and low cost possible. Compared with the traditional IoT technology, this technology can cover the IoT as a whole, can improve the stability of the operation, and can improve the information. The efficiency of communication between them meets the specific requirements of long-distance communication. It can be seen that the narrowband Internet of Things communication technology can provide guarantee for smart transportation construction.

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