Traffic Information Network Demand Analysis Based on Internet of Things

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Abstract: The traffic information under the condition of Internet of things mainly refers to the traffic information related to the traffic operation status and traffic management that meets the technical standards of Internet of things. Compared with the traditional traffic information, it emphasizes the requirements of adapting to and serving the perception, transmission and network of the Internet of things, and only in this way can it meet and support the requirements of "everything connected" of the Internet of things. The network refers to a huge virtual picture, connecting all things [1]. The network is a virtual platform for information transmission, reception and sharing, through which the information of various points, faces and bodies are linked together, so as to realize the sharing of these resources. Therefore, the regional traffic information network is a complex system based on many subsystems. The system can achieve many functions, and can be connected with various horizontal and vertical networks to realize resource sharing and information integration. It is not only necessary to collect, transmit and process massive traffic information, but also to sort out, summarize, integrate, deeply excavate and share these countless kinds of information, and finally realize cross system, cross region and cross industry information interaction and sharing, so as to promote the sustainable development of regional traffic benefits.

Characteristics of the Internet of Things

The Internet of things is the forefront of information technology development and the integration of high-tech in many fields. As a system network, the Internet of things has its unique network architecture. The Internet of things system has three levels

(1) The perception layer solves the problem of data acquisition in the human world and the physical world, that is, using RFID tags and readers, two-dimensional barcodes, sensors, video cameras, GPS and other devices in the streets, bridges and tunnels, buildings, vehicles and pipe networks to obtain relevant information of objects anytime and anywhere. The main function of this layer is to realize the perception, recognition, monitoring or data collection of objects, as well as the response and control. The key technologies needed in the sensing layer include detection technology, wireless transmission technology, ad hoc network technology and middleware technology.

(2) The network layer solves the problem of transmitting and preprocessing the data obtained by the perception layer, that is, integrating various telecommunication networks and the Internet, transmitting and preprocessing the sensed object information, which we call the neural system and brain of the Internet of things vividly. The key technologies needed in the network layer include long-distance communication technology, network technology, etc.

(3) Application layer, which solves the problems of information processing and information application service, including the support technology of Internet of things application and the practical

application of Internet of things. That is to analyze, process, store and filter the information obtained by the perception layer, provide the services required by users, and intelligently identify, locate, track, monitor and manage objects. The application layer reflects the development trend of the Internet of things, and it is also the key to broaden the industrial demand and bring economic benefits. The key technologies needed in the application layer include open information platform, cloud computing platform and service support platform.

Since the Internet of things can trace, communicate and control every object in the network, it has three characteristics of "comprehensive perception, reliable transmission and intelligent processing".

Impact of Internet of Things Technology on Traffic Information

Through the analysis of the characteristics of the Internet of things in the last section, we can see that the collection, transmission and processing of traffic information under the Internet of things technology have undergone profound changes compared with the traditional traffic information. These changes are not only reflected in the perception layer, but also in the network layer and finally reflected in the application layer. Comparative analysis of the similarities and differences between the traffic information under the Internet of things technology and the traditional traffic information is an important part of the research on the demand analysis of traffic information based on the Internet of things. This section mainly makes a comparative study on the collection, transmission, processing and service methods of traffic information from the Internet of things technology.

The Influence of Internet of Things on the Way of Information Collection. The collection of traffic information is the premise of data processing and comprehensive utilization. The traditional collection methods of traffic information are mainly manual collection, fixed collection and passive collection [2]. For static information, such as urban road network basic information (such as road technology level, length, toll, interchange connection mode, etc.), urban basic geographic information (such as road network distribution, division of functional areas, layout of intersections, urban infrastructure information, etc.), vehicle ownership information (including information on vehicle ownership by region, time, different vehicle types, etc.), and traffic Management information (such as one-way driving, no left turning, limited access, etc.) is usually obtained by means of manual investigation or instrument measurement. The characteristics of this collection method are that the collection workload is large, and it belongs to repeated work, and it does not need to

Under the Internet of things, the traffic information collection is mainly automatic, mobile and active. The collected objects usually carry two-dimensional code labels, RFID tags, sensors or GPS terminals, which have high intelligence and better identifiability. The traffic information collection under the Internet of things is mainly through the identification of vehicles (goods) and other tested objects to carry out automatic collection [3]. The collection equipment / system is not installed in a fixed place but on a movable facility. For example, when GPS floating car collects road traffic flow or other vehicle violation information, the collection equipment / system itself is movable, and the collected object is also mobile, and the relative distance between them is not fixed. Taking the acquisition technology based on GPS positioning, RFID and cellular network as the representatives, it can collect the relevant information of any target anytime and anywhere. Only when the detected object interacts with the collection device / system can the information collection be realized. According to the above analysis, the biggest difference of traffic information collection under the Internet of things technology is that "things" are both information providers and information collectors.

The Influence of Internet of Things on Information Transmission. The traditional transportation information transmission mode usually adopts the fixed and wired mode, and the information access point is fixed. The selection of access point is usually based on the geographical location and previous work experience. The information flow direction is usually fixed, and it is one-way transmission, often one-way centralized transmission to one or several home points. In actual use, although these transmission networks contain huge information transmission capacity, they only

transmit a small amount of data information. There is a significant gap between the potential of information transmission and the actual level of use, and the one-time investment cost is high, the actual resource utilization rate is low, which to a certain extent hinders the road network construction and even the development of social economy. Up to 2009, in terms of communication resources, communication pipelines (including silicon core pipes, multi wall corrugated pipes, cement pipe holes, etc.) have exceeded 400000 km, optical cables (above 24 or 32 cores, g652 standard) have exceeded 100000 km, program-controlled switches have more than 400 sets, initial installed capacity is about 400000 lines, and expansion capacity is more than 3 million lines. In fact, most of these communication resources are only used for network charging and monitoring, far from giving full play to their due resource effect (data from 2009 statistics of the Highway Research Institute of the Ministry of transport).

Positioning of Traffic Information Network

Transportation is the general term for all kinds of transportation and post and telecommunications. That is, the operation and transmission of people and things; the transmission and transmission of languages, words, symbols, images, etc. [4]. Information refers to the "difference between two uncertainties" of things before and after people get information. The meaning of traffic information is: traffic information is processed traffic data, which is useful for all users and managers of traffic facilities, has practical or potential value for traffic management decision-making or traffic behavior, is to provide specific departments and the public with knowledge about the actual situation of road network traffic, is the meaning contained in the data and information, it does not follow the physical equipment form of the carrier And change. Traffic information has objectivity, practicability, transmission and sharing.

Hierarchy of Traffic Information Network

According to the three-tier architecture model of the Internet of things architecture, the traffic information network is modeled hierarchically, and the function and nature of the model are described from the perspective of the system. The hierarchical model of regional traffic information network based on the Internet of things is shown in Figure1.

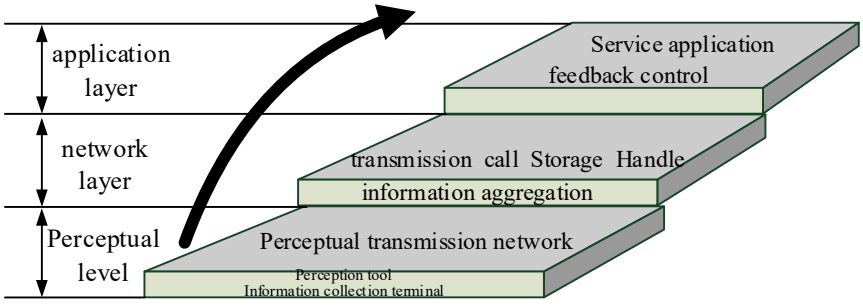

Figure 1. Hierarchy of regional traffic information network based on Internet of things

(1) Perception layer: collect all kinds of traffic information comprehensively, accurately and reliably, and transmit it to the network layer timely and accurately from the perception transmission network.

(2) Network layer: sort and classify the information provided by the perception layer, establish databases with different functions according to the requirements of different departments or services, and manage the databases. The regional traffic information network based on the Internet of things emphasizes the sharing and full utilization of information, and the dynamic operation and selection of traffic information are completed by the network layer.

(3) Application layer: mainly realize the application service of traffic information. For traffic users, it is mainly for service applications, such as travelers' choice of travel routes according to costs; for traffic managers, it is mainly for feedback control, such as adjusting traffic signal control according to real-time traffic flow information.

It should be noted that for the purpose of research, the traffic restriction in this paper refers to road traffic. As an open network system, the regional traffic information network based on the Internet of things forms a virtual and unified traffic information computing environment with traffic data collection equipment, computing resources, mass storage, heterogeneous database, knowledge resources, etc. it provides a high-performance computing, resource collaborative management and application service ability, which can store and distribute the collected mass dynamic data To integrate these information for the regional traffic information system. At the same time, any node of the whole Internet of things (including people and things) can also be used as long as there is demand, only in this way can fully reflect the essence of the Internet of things "everyone exchanges, things connect".

Architecture of Traffic Information Network

As the framework of traffic information network system, it includes system logic structure, physical structure, data flow and software system structure. This section focuses on the logical structure of the system. Based on the location and network level model of regional traffic information network in the environment of Internet of things, the system architecture based on the traffic information network of Internet of things is proposed as shown in Figure 2-5. The system architecture is mainly divided into three parts: perception layer, network layer and application layer.

Traffic Information Demand and Characteristics Based on Internet of Things

Traffic information in the demand of Internet of things can be divided into static information and dynamic information according to its frequency variation characteristics. In this section, traffic information is divided into static traffic information and dynamic traffic information for demand analysis, and then the differences and connections between different information are studied.

Static Traffic Information Demand Analysis. Static traffic information is a relatively stable traffic information in a period of time, which has the characteristics of stable, easy to identify, easy to obtain and easy to maintain. The data source can be obtained from the existing databases of various systems and departments (such as planning department, urban construction department and traffic management department), and can also be obtained and supplemented through traffic survey or various intelligent transportation technology means such as remote sensing (RS), global positioning system (GPS) and geographic information system (GIS).

(1) Road infrastructure information needs

Road is a kind of engineering facility for all kinds of vehicles (trackless) and pedestrians. From the perspective of Internet of things technology, road infrastructure information refers to the information that describes its regular performance, characteristics and indicators, mainly including three categories. The first is the basic information of the road, such as the technical level of the road, the number and width of lanes, geometric alignment, traffic mileage, speed limit, stopping sight distance, three-dimensional connection mode, intersection capacity, etc. The second type is the information of special structures (bridges, tunnels, culverts, entrances and exits, toll stations, etc.), such as location, geometric scale, traffic capacity, design vehicle load of bridges and culverts, number of lanes, height limit, width limit, weight limit, and type limit of transportation goods, etc. The third is auxiliary service information, such as gas station information, vehicle maintenance service, service area / parking lot information, shopping and catering.

(2) Road network information demand

In today's society, the object of road management is no longer a single road, but a gradually networked regional road. Traffic participants not only pay attention to various information of a single road, but also pay more attention to the comprehensive information of specific regional roads; users

not only pay attention to the current traffic information of the current road section, but also require to get the traffic information of the road section they plan to pass through. For road network planning, after the basic scale of road network (such as road area ratio) is determined, the first problem is how to choose a reasonable road network structure according to the dominant traffic mode determined by the traffic development strategy. In the book "urban traffic management evaluation system", Lu Huapu proposed to use "road network density, main road density, per capita Road area, pavement integrity rate, main road lighting rate, parking space of 100 vehicles" to measure the construction and improvement degree of urban road infrastructure according to four aspects of network scale, network structure, grade structure and road intersection. The commonly used indicators of road network information are: population density, area density and comprehensive density of road network. Road network population density (km or 10000 people) refers to the number of road infrastructure owned by the unit population in the area where the road network is located; road network area density (km or 100 square kilometers) refers to the number of all road infrastructure owned by the unit area: the comprehensive density of the road network considers two variables of unit area and population at the same time, according to the area and people in the area where the road network is located Product calculation of mouth （Its formula is $\delta = \frac{L_N}{\sqrt{A \times P}}$, Where ln is the total mileage of the road network, a is the area of the area, and P is the total population in the area of the road network.)

(3) Traffic management information demand

On the one hand, traffic management reasonably guides, restricts and organizes the traffic flow on the road network according to the traffic laws and regulations; on the other hand, it provides various information to the traffic travelers and traffic operators to serve the traffic. Conventional traffic management information mainly includes: all kinds of traffic engineering facilities information, emergency rescue facilities and organization information, driver and vehicle file information, parking lot information, vehicle inventory statistics information, traffic transfer information, traveler travel rule information, urban basic geological information and other related information.

(4) Traffic social environment information demand

Transportation has a far-reaching impact on human life. In all fields of politics and economy of human society and in all aspects of life, such as clothing, food, housing and transportation, all of them are closely related to transportation. On the contrary, the regional economic development, industrial layout and urban development also affect people's choice of transportation. Traditional transportation studies mainly focus on the relationship between various elements in the transportation system, not on the relationship between transportation and the wider human life. Traffic under the Internet of things is a concept of social traffic that pays more attention to mutual interaction. Therefore, the impact of politics, economy, culture, religion and traffic accidents in the traffic social environment is more obvious. Generally, a friendly political environment is more likely to attract more people. In an economically developed region, people pay more attention to the fast mode of transportation. In an area that emphasizes green culture, people prefer to choose green transportation. In particular, it should be pointed out that the impact of traffic accidents on traffic is more prominent among these factors. A road prone to traffic accidents, travelers may choose to detour. For example, the major traffic accident of 7.23 Wenzhou Ningbo high speed railway directly leads to people's fear of the high speed railway. Some scholars pointed out that "before the impact of the major traffic accident of 7.23 Wenzhou Ningbo high speed railway, accidents or changes in travel concept, and before the safety of the high speed railway system has not been effectively confirmed, the travel choice of business travelers will be more inclined to aviation." [5]. Therefore, the social environment information of regional transportation mainly includes: the level of regional economic development, population scale, geographical conditions and location factors (including political location, economic location and geographical location).

Demand Analysis of Dynamic Traffic Information. Dynamic traffic information usually changes in a short period of time, and its change cycle is between minutes and seconds [6]. Its data source is

mainly realized by various road traffic detection technologies. With the continuous innovation and development of sensor technology, wireless communication technology, video image processing technology and computer technology, real-time and dynamic collection of traffic information has become a hot spot and gradually become a reality.

With the continuous development of economy, social progress and the acceleration of urbanization process, the sharp increase of traffic demand and traffic flow in the region highlights one of the prominent contradictions in the current social life field of our country - the traffic supply can not meet the increasing traffic demand of the people, the continuous increase of vehicle ownership, which further aggravates the road traffic load, No matter urban road or highway, traffic congestion and congestion of different degrees almost become a kind of normal, serious congestion and even traffic paralysis in some regions are not uncommon, which greatly reduces the transportation efficiency and efficiency of regional road network, affects people's daily travel and life, restricts economic development, so it is particularly important to identify the traffic status.

Traffic state refers to the running state of road traffic flow or vehicle flow. Effective identification of road traffic status is an important means to prevent or reduce the degree of road traffic congestion. The identification of traffic status should take into account traffic volume, speed, traffic density, occupancy, headway, delay and other traffic information, qualitative or quantitative analysis of traffic flow in time and space, through the selection of indicators, algorithm and other factors to identify The road traffic state that can fully reflect the real situation of traffic operation . In this way, the traffic manager can timely take corresponding control measures for the road section and even the road network traffic flow according to the real-time road traffic status to ensure the smooth driving and road.

Conclusion

Starting from the concept of the Internet of things, this paper analyzes the three characteristics of the Internet of things: comprehensive perception, reliable transmission and intelligent processing, analyzes the multi-faceted impact of the Internet of things on traffic information, and determines the location and hierarchical architecture of the regional traffic information network based on the Internet of things in combination with the technical characteristics of the Internet of things. On this basis, the demand analysis of regional traffic information based on the demand of the Internet of things is clarified, and the demand characteristics of traffic information under the Internet of things are summarized.

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