

Explore the Impact of Smart Transportation on Urban Transportation Planning

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Abstract: With the increase and concentration of vehicles and population, a lot of people are beginning to focus on urban traffic problems, and smart transportation, as a means to effectively solve people's traffic problems, has received more and more attention. This article introduces smart transportation and the role it can play. It also introduces some core technologies and methods of smart transportation from three important perspectives: 5G technology, big data technology, and public transportation priority. The passage also takes Singapore's advanced smart transportation as an example for in-depth exploration and then draws the advantages compared with traditional traffic planning through comparison. Finally, it shows that smart transportation is of great significance for countries around the world to solve modern traffic problems and proposes an important direction for the development of urban transportation in the 21st century. All signs indicate that smart transportation will play an increasingly important role in future urban construction.

1 Introduction

Smart transportation is a significant topic in the 21st century. With the intensification of global urbanization, energy shortages, environmental pollution, and traffic congestion, its importance is increasing day by day. As part of smart cities, smart transportation deepens system functions through information technology, is committed to solving the bottleneck of the transportation system and realizes intelligent and sustainable development.

In today's era, the global urbanization process is accelerating, especially the large-scale influx of population in developing countries into cities, making urban population density increasingly large. At the same time, this has also led to a rapid increase in urban transportation demand and brought tremendous pressure to the original urban transportation system. The increase in urban population will also lead to traffic accidents and safety problems. However, traditional traffic management methods have a certain limit on the prevention of traffic accidents, but smart transportation can be used through real-time monitoring, 5G technology, and other means to significantly reduce the accident rate.

The research scope of smart transportation is wide, covering multiple technical fields, including intelligent traffic management systems, big data technology, 5G technology, and intelligent public transportation systems. As technology continues to evolve, smart

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transportation systems are also continuously optimized to adapt to new needs and challenges. The popularity of fuel vehicles around the world has exacerbated air pollution and climate change. Smart transportation reduces dependence on traditional fossil energy and reduces carbon emissions by utilizing new technical means and concepts such as electrification, automation, and shared travel.

This article explores the solution of human traffic problems to smart transportation. The concept of smart transportation and three core technologies and methods of smart transportation can solve the urban traffic problems faced. It also explores the application and functions of smart transportation by example and contributes to solving human traffic problems.

2 Smart Transportation Overview

Smart transportation is an intelligent system that uses modern information technology. Smart transportation can solve many problems in urban transportation, provide intelligent transportation services for pedestrians and vehicles, and respond to national environmental policies to provide a green environment for the public. Smart transportation can realize real-time sharing of urban traffic spatial data. It also uses information technology and network transmission technology to establish an integrated transportation system, provide real-time travel strategies and plans, and rationally plan urban transportation to ensure people's efficient and safe journeys [1]. Simply put, smart transportation combines intelligent interactions between roads, vehicles, passengers, signal systems, and infrastructure to improve traffic efficiency, thereby achieving the purpose of improving travel safety, reducing energy consumption, and environmental pollution, and improving traffic efficiency. At the same time, it provides travellers with more convenient services, which can effectively alleviate traffic congestion and reduce energy consumption and environmental pollution [2]. In addition, the core of smart transportation is to achieve intelligent management and optimal allocation of transportation resources [3]. Due to its characteristics, the intelligent transportation system can provide many services for the city. While intelligently managing traffic plans and traffic order, it can also improve the construction services for the city, generate many services that are beneficial to urban development, and thus positively drive the development of urban construction and improve the intelligence level of the city. The construction services of the intelligent transportation system can improve the road conditions of the city, improve the efficiency of road traffic management, and reduce unnecessary capital expenditures [4].

3 Core content of smart transportation

3.1 Technology

3.1.1 5G technology

The utilization of 5G technology has become one of the significant driving forces for promoting the intelligentization of transportation systems. 5G has the characteristics of ultra-high bandwidth, ultra-low latency, and large-scale device connection, which provides solid technical support for various application scenarios of smart transportation. It realizes the high integration of multiple different types of networks and provides high-speed, secure and free communication between people and objects, and between objects with integrated and unified standards, so as to achieve stable and fast network operation and realize the

purpose of the interconnection of all things [5].

Autonomous vehicles will generate massive amounts of image, video, and radar data during operation. The characteristics of 5G networks allow various sensors and cameras to be widely deployed in locations such as roads, bridges, and transportation hubs to collect data such as vehicle flow, road conditions, and accident information. Traffic management personnel can conduct dynamic traffic control based on real-time information, such as adjusting traffic lights and issuing real-time traffic warnings. 5G can support the connection of millions of devices at the same time, and its existence helps to achieve comprehensive digital management of the entire urban transportation network.

3.1.2 Big Data Technology

Big data usually means a collection of information that cannot be gained, controlled, and utilized. It refers to a large amount of data with a high growth rate and diversity that can generate higher management capabilities, insight recognition capabilities, and process optimization capabilities through information management methods [6]. With the popularization of IoT devices, and the advancement of sensor technology, transportation systems generate massive amounts of structure. Thus the technology can help traffic managers optimize decisions, reduce congestion, and improve safety by collecting, storing, processing, and analyzing these data. To this extent, it can also provide personalized travel services for passengers. Massive traffic data has the characteristics of large data volume, multiple types, diverse forms, fast generation speed, and density that are common to general big data [7]. Big data technology can process traffic flow data, quickly discover traffic congestion points, accident areas, etc., and issue traffic warnings in a timely manner. In the context of building a strong transportation nation, making better use of Internet big data technology to empower the development of smart transportation has become an important task [8]. Big data technology is gradually developing towards multimodal transportation integration, that is, integrating data from different modes of transportation (such as buses, subways, shared travel, cycling, etc.) to achieve seamless travel planning. AI-based algorithms can mine more accurate patterns and trends from massive traffic data to optimizing traffic flow control, vehicle scheduling, accident prevention, etc. In addition, big traffic data analysis also covers the actual data analysis of road traffic conditions, and can perform big data analysis on OD, traffic, professional videos, etc.; it can also perform data analysis on facial recognition technology, license plates, and traffic events [9].

3.1.3 Public

Public transport priority is an important strategy in the smart transportation system. It aims to provide guarantees for the priority passage of public transport tools (such as buses, subways, light rail, etc.) in the traffic flow through advanced technical means and management measures. Public transport priority can be achieved through information and digital means. For example, by real-time monitoring of the location and number of passengers on buses, buses can be dispatched with priority to improve the efficiency and satisfaction of public transport services [10].

In today's era, AI algorithms can predict peak traffic flow and provide support for public transport priority scheduling. The low latency and large bandwidth characteristics of 5G technology provide more powerful technical support for public transport priority. 5G can achieve high-speed data transmission between buses, traffic lights and traffic management centres, thereby achieving more real-time and more accurate traffic control. In addition, investment and maintenance of public transportation facilities should be strengthened [11].

One of the future development trends is the deep integration of multimodal travel. For

example, on a trip, multiple different modes of transportation are used to achieve a convenient, efficient, and green travel mode. This conceptual design integrates multiple modes of transportation, usually including public transportation (such as light rail, subway, and bus), shared transportation, walking, cycling, and private cars. The purpose of multimodal travel is to provide passengers with flexible and time-saving solutions to traffic problems to cope with the increasingly complex urban traffic needs. The smart transportation system not only gives priority to buses and subways but also seamlessly integrates multiple modes of transportation. The government can use big data analysis and real-time scheduling, and multimodal transportation can flexibly respond to different travel needs and improve citizens' sense of happiness in transportation.

3.2 Application case analysis

The construction of smart transportation should take improving citizens' travel experience as the core goal. Through a more convenient public transportation system, safer road design, and a more flexible combination of multiple transportation modes (such as shared bicycles, online car-hailing, etc.), smart transportation not only provides urban residents with efficient travel methods but also promotes green travel and reduces environmental pollution. Based on resource optimization and efficient utilization, smart transportation can make traffic sources (such as roads, vehicles, and traffic lights) more reasonably allocated through data analysis and prediction.

Singapore has a land area of only about 728 square kilometres but has a population of over 5.6 million, which results in a heavy load on the transportation system. In response to limited road resources and growing transportation demand, the Singapore government has been promoting a technology-based transportation management system since the 1970s.

The Singapore government emphasizes green and sustainable development in its transportation planning and promotes the environmental protection of the transportation system through strategies. Singapore has planned a 2040 goal, expecting to achieve 75% of travel through public transportation. Singapore also implements a strict vehicle ownership certificate system. Citizens need to obtain a vehicle ownership certificate through bidding before they can buy a vehicle, and the price of each certificate fluctuates according to market demand. This system greatly limits the number of private cars and prompts citizens to rely more on public transportation. This also makes Singapore's public transportation system more developed. Singapore's public transportation system, including subways and buses, has received a lot of government investment and priority support for development. The expansion and renewal of its subway system and the construction of a rapid bus system ensure the convenience and reliability of public transportation. According to statistics, Singapore's traffic speed ranks among the highest in the world's major cities. At the same time, Singapore has a first-class public transportation infrastructure, and its extensive subway, bus, and rapid transit systems provide citizens with convenient travel options. The intelligent bus dispatching system ensures that buses run on time and efficiently. In terms of policy, Singapore has greatly reduced carbon emissions from urban transportation by restricting the use of private cars, promoting electric vehicles, and optimizing public transportation, setting an example for sustainable development of cities around the world.

3.3 Comparison

Traditional transportation planning often focuses on infrastructure construction. Its core is usually the construction of roads, bridges, tunnels, etc., and the expansion of transportation networks to meet the growing transportation demand. It is also planned based on long-term traffic flow forecasts, which makes its design relatively fixed and difficult to flexibly

respond to short-term changes in transportation demand. In terms of transportation planning, traditional transportation is more concerned about how to improve overall transportation efficiency by increasing road capacity and expanding public transportation networks but pays relatively little attention to the optimization of personal travel experience and environmental impact. It mainly relies on the construction of hardware facilities, such as roads, bridges, tunnels, and bus stations. In terms of economic practicality, once these facilities are built, the space for management and optimization is relatively limited, and the maintenance cost is high. Its characteristics determine that it usually relies on traffic police or traffic management centres to monitor traffic conditions through surveillance cameras, road patrols, etc. Because accident handling and emergency management are mainly based on manual judgment, this leads to its slow response speed and inability to achieve real-time regulation. Traditional traffic management is usually based on broad rules and provides popular travel services.

In terms of environmental protection, smart transportation attaches more importance to it. It encourages the use of low-carbon travel modes such as public transportation, shared travel, autonomous driving, and electric vehicles to reduce traffic pollution and carbon emissions. At the same time, smart transportation systems can use massive traffic data for analysis and prediction, helping traffic managers identify potential problems in advance and make adjustments. This information is very important for traffic management departments because it can help management departments understand the current traffic conditions and make reasonable decisions [12].

4 Suggestions and Prospects

As an important direction for urban development in the 21st century, smart transportation needs continuous improvement and innovation in all aspects to cope with the ever-changing transportation needs and technological changes. For example, strengthen technological innovation and integration, and improve data management and sharing capabilities. Smart transportation relies on large-scale data collection, analysis and application. The successful implementation of smart transportation also needs to focus on the green design of infrastructure construction, environmental protection, and sustainability. The sustainable development concept of smart transportation should be incorporated into urban planning in advance, such as using transportation facilities powered by renewable energy and building green transportation corridors. The government should also strive to gain the support and understanding of citizens. It can improve citizens' awareness and acceptance of smart transportation through various media channels, school education, and community activities.

As smart transportation develops, there are still some problems that need to be improved and solved. For example, it can no longer meet the latency requirements of new vehicle applications such as assisted driving and autonomous driving [13]. At the same time, since smart transportation systems mostly obtain, process, and analyze information from computers and the Internet, they are exposed to potential information security threats on the Internet and are also attacked and invaded by hackers, which has a great impact on information security, causing huge losses, increasing the risk and threat factors of information security, and increasing the probability of danger [14]. Today, information security is particularly important. The protection and security of smart transportation systems should be given equal attention. People should not lose sight of each other. Reducing the incidence of road accidents and improving road safety have long been urgent needs [15].

5 Conclusion

This paper studies the methods and effects of smart transportation. Transnational logistics, smart ports, smart airports, etc. achieve seamless connection through information technology, optimizing the efficiency of international goods and personnel flow. For example, global supply chain management benefits from the support of smart transportation, and logistics transportation is more accurate and fast. Many countries and regions promote technical interoperability and data sharing by jointly formulating transportation standards and regulations. For example, EU countries have close cooperation in the fields of smart transportation and green travel to ensure that transportation systems in different countries can work together. In some developing countries or regions, the backwardness of the transportation system has led to unbalanced social and economic development. Smart transportation provides an efficient solution for these regions, using low-cost smart technology to improve transportation infrastructure, and improve residents' travel conditions.

In the 21st century, smart transportation will continue to develop with the advancement of technology. In the future, smart transportation will not only achieve fully autonomous driving but may also further integrate systems such as smart grids, smart cities, and smart homes to achieve the true "Internet of Everything".

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