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Research on model-designing & architecture of intelligent transportation system based on internet of things

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ABSTRACT

With the rapid development of economics and technology; the number of vehicles has largely increased. In this paper, there is a new kind of ITS model as well as architecture has been established in the dissertation; then the architecture is evaluated and quantitative analyzed by AHP calculation; ultimately, the result shows that the new ITS architecture based on IOT environment is operated better than the present. Expanded the ITS to get the scope to enhance the perception of node information and awareness, and overall perception of the road of traffic node information, which will be able to enhance the IOT in the application of ITS and promote ITS extend to the physical world at the same time. In view of the rapid development of the transportation industry and accelerate the intelligent traffic, we can improve the current traffic conditions and the efficiency of commuter transport, which has extensive and profound significance to solve the bottleneck of economic development.

KEYWORDS

Intelligent transportation system; Internet of things; Architecture; Model-designing.

INTRODUCTION

The nature of Internet of Things is the physical infrastructure and IT infrastructure integration, which can achieve things and things, things and people between information acquisition, transmission, storage, integration and use. The characters include perception of things perfect convergence of identification, communication transmission and intelligent control. The meaning of things and the development process showed that: all kinds of technical things is a highly integrated network, all kinds of complex and technical principles involved in many areas, which has not yet formed a unified technical standards system in the world.

Internet of Things as an aggregation of complex systems, mainly composed of three parts: sensing control layer, using RFC, two-dimensional code, sensors perceive the object recognition; network transport layer, the data from the sensing layer identification information through the Internet, radio and television transmission network, mobile communications network and other infrastructure bearer network to the application service layer; application service layer, the use of cloud computing, data mining and other computational intelligence techniques to complete the control and management of intelligent objects, and apply it to specific areas of the industry[1].

Technical characteristics of things determines Internet of Things in all walks of life will have a very broad application space factory, in respect of the transport sector, the introduction of Internet of Things technologies can achieve intelligent transportation. Intelligent Transportation Systems (ITS) fusion RFID, sensors, wired/wireless communication, data mining, data analysis and processing, GPS location, status monitoring, automatic control, information dissemination, and other advanced technologies to achieve the intelligent management of the entire transportation system, will become mainstream in the future development of the transport system. Internet of Things in the transport sector currently typical applications include: intelligent traffic signal control systems, traffic guidance systems, intelligent parking systems.

Intelligent transportation

Intelligent Transportation is the future direction of the transport system, it is the effective integration of advanced information technology, data communications transmission technology, electronic sensor technology, control technology and computer technology, which are applied to the entire surface of a traffic management system and the establishment of in a wide range, full play to the role of real-time, accurate and efficient integrated transportation management system intelligent Transportation has the following two characteristics: First, focus on a wide range of applications and services traffic information, the second is focused on improving the existing traffic operating efficiency of facilities[2].

Compared with the general technology systems, intelligent transportation systems integrity requirements of the process is more stringent. Such integrity is reflected in: Intelligent transportation system construction involves many industries, is a complex system engineering giant community-wide participation. Intelligent Transportation Systems has integrated traffic engineering, information engineering, control engineering achievement, communication technology, computer technology, and many other scientific fields, require many skilled work together. Government, enterprises, research institutes and universities to participate in, locate the appropriate roles and tasks share, which is an important prerequisite for effective system expanded. Intelligent Transportation Systems will be dominated by mobile communications, broadband networks, RFID, sensors, cloud computing and other new generation of information technology for support, more in line with application requirements, improve the degree of trustworthiness and become ubiquitous.

The 21st century will be the century of intelligent transportation, and people will be using the Intelligent Transportation System, which is an advanced integrated transport integrated management system. In this system, a vehicle travel is on their own intelligence freedom on the road, the road traffic is on its own intelligence will be adjusted to the optimum state. Intelligent transportation is based on modern electronic information technology systems for the transportation service. Its salient features are information collection, processing, dissemination, exchange, analysis, use of the main line, to provide transportation services for the diversity of the participants.

Needs analysis of intelligent transportation system

Urban traffic guidance system is currently accepted to fully and effectively alleviate the transport sector to solve problems, especially traffic congestion, one of the best ways to traffic jams, accidents, and traffic pollution and a series of traffic problems. The so-called intelligent transportation systems, is to people, vehicles, road and environment through communication, information, and other high-tech means to organically combine to achieve road safety, smooth, low pollution and low power consumption of software systems is a promotion of harmony between man and the environment of road transport integrated technology development[3].

Urban traffic flow guidance system is based on the theory of dynamic traffic assignment, real-time traffic conditions on the road network to analyze complex, integrated use of 3G technology, advanced communications and computer technology. Currently appear overwhelming concept of things, in the face of real-time urban traffic flow guidance system complexity can be considered through the use of Internet of Things technology to achieve secondary traffic flow guidance system, the perfect solution to promote traffic-induced problems. The use of on-board computer, radio and other facilities dynamic, real-time optimal path to provide guidance to travelers instruction and real-time traffic information, and ultimately achieve the purpose of balancing network traffic flow, thereby reducing the length of stay of vehicles on the road, effectively preventing traffic congestion occurs, and ultimately achieve optimal allocation of traffic on each link in the network.

This paper briefly discusses Internet of Things based urban intelligent traffic flow guidance system and the needs of the system analysis and system functions and so on. The goal of building this system are: establishment of the Internet of Things system based on traffic flow guidance, a user through the car system shortest path analysis, geographic information

query, vehicle location and bus route search functions, real fast, green, safe, and comfortable traffic environment and promote sustainable development of cities[4]. Figure 1 shows the intelligent traffic under Internet of Things.

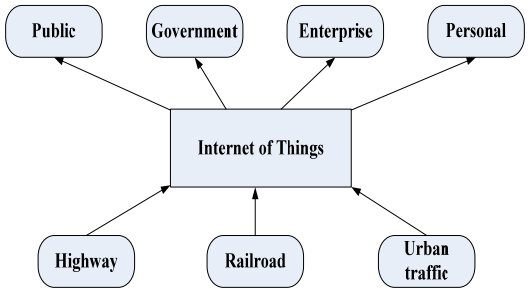

Figure 1 : The intelligent traffic under internet of things

Model-designing & Architecture of IOT

In the case of the wide application of networking technology, the field of intelligent transportation systems of the services provided broader. The establishment of a network of intelligent transportation system services model based on the application of materials, through the analysis of different types of service users in all aspects of demand and transportation systems available, can better play networking technology and intelligent transportation systems, and improve infrastructure utilization.

ITS system control center is responsible for traffic control, vehicle identification, vehicle parked integrated management, public transport time planning, urban transport planning and traffic management based on statistical knowledge; at the application level is divided into three areas: application services, building maintenance management and operational control.. In the application service road traffic information center to collect information, real-time weather conditions, the schedule also includes public vehicles, road network of digital maps and some route guidance algorithm under certain conditions, transferred to the management and traveler information service needs, important part of the operation control embodies the characteristics of Things intelligent transportation systems, the core part of that feedback and control information, focusing on scheduling, transportation cargo transportation route planning behavior, and safety of the vehicle and the operating environment, higher demands.

Things intelligent transportation system as an open network-based system, information collection perception layer, the network layer transmission and information processing, application layer scope and level of service will increase as technology advances and demand continues to expand and improved. Basic level is the perception layer networking technologies in intelligent transportation application, which provides an efficient means of information exchange technology for top job control and business management, and physical events and data collection of traffic environment for the entire transportation system. In the perception layer is divided into data acquisition and sensor networking information layer co-processing of two parts. Network layer can achieve a more widespread application of Internet capabilities in intelligent transportation systems, and perceive the information accessible, efficient and secure transfer of information, and therefore need to sensor networks and mobile communication technology, Internet technology integration. Due to the need for intelligent transportation systems and perceived end-aware network node address management identified and resolved, so the network layer of the Internet of Things should provide the appropriate information resources management and storage technologies, M2M wireless access and remote control technology in order to achieve things direct intelligent control things and things[5].

Application layer is based on traffic data resources collected by the perception layer into a platform for intelligent transportation systems, the formation of various transport subsystem application specification data through a unified standard, used in supporting platform and application services, including data interface used to support cross-industry, cross-application, cross system collaboration between the information sharing, interoperability features. Things data in support of the main applications of intelligent transportation system is divided into four modules: traffic management systems, customer service systems, traffic management systems, traffic control systems. Figure 2 shows the intelligent transportation systems under Internet of Things.

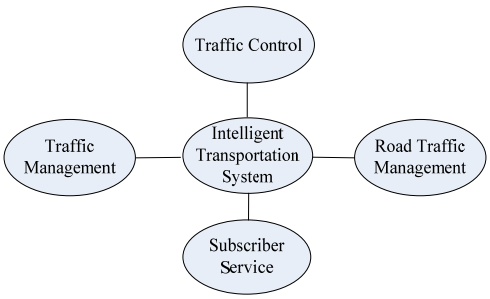

Figure 2 : The intelligent transportation systems under Internet of Things

Traffic management system includes transportation planning and decision-making, logistics management, environmental management, public transport services and so on. Transportation planning and decision making on the basis of things collected traffic data, combined transport activities, in accordance with the appropriate transport planning theories and methods, the final proposed plan and decision-making advice; logistics management system in accordance with the law of the main contents of the flow of material entities, transport activities by planning, organizing, directing, coordinating, controlling and supervision so that all the logistics activities to achieve optimal coordination and cooperation. Intelligent Transportation Systems networking environment in user services focus on people-oriented, to provide users with real-time online information services and travel information services, will pass things in a flood of traffic information resources, effective information to the client terminal; system combines civil aviation and railways, etc. transportation, to provide users with fast and convenient travel booking service; customer service system in the user through the process of independent travel management induction of vehicles or other terminal equipment, in order to achieve stable operation of the road network traffic flow requirements[6].

Road traffic is divided into four areas of intelligent traffic management integrated information management, automatic detection system, signal control system and police chain of command. The key step traffic control system to achieve intelligent transportation system under the flow of information: the feedback control. Perception layer acquired data to the transportation system for transport planning and traffic flow optimization, is the core part of the traffic control and management. Which transportation decision support, including traffic simulation and traffic information statistical analysis, to provide information processing support for the system operator to the transport process; transportation business management for incident handling, vehicles and personnel controls and Highways facilities management were on the thing a person/ vehicle-environment one on one control and management.

Optimization design of path under intelligent transportation system

Urban traffic flow guidance system needs to interact with the hardware and software implementation. Urban traffic flow guidance system induced by the information center, vehicle guidance information system composed of two parts. Traffic flow guidance information center induces traffic flow completing the acquisition of data, processing and publishing. In-vehicle information and communication system to complete guidance information, route optimization and information query. The hardware side Internet of Things is to be designed as a precondition. Figure 3 shows the overall system structure.

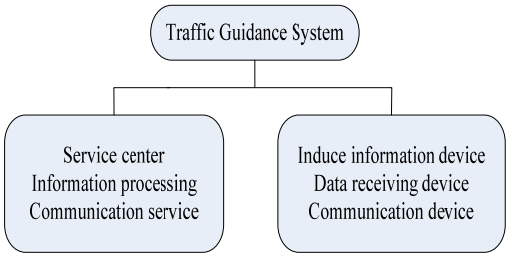

Figure 3 : The main program flow of system

Urban traffic flow guidance system is built on the basis Internet of Things, and detailed planning and design for software development in some cities traffic guidance systems. The advantage is that you can integrate things together online resources together to achieve shared resources, the use of data. Basic data traffic guidance information module is a real-time road travel time travel time prediction by the software based on the acquisition of road transport infrastructure and traffic generation. Final Guidance Information System client software is released by the data communication from the information center to the client[7].

Optimal path search module uses resistive multi-objective-based database constrained optimal path algorithm to dynamically road resistance to the weight of each section, and calculate the optimal route starting and destination, and are stored in a variable way by road. Optimal path display module will search to find the optimal path corresponding to the above geographical entity object sections, so it is highlighted on the screen. When updating the optimal path, the program will automatically call the latest optimal path, re-displayed on the screen. Route guidance module: This module can guide the driver along the route the vehicle path planning module provides traveling. This module is performed in real time in the case of the road in the driver's steering commands to provide real-time in the form of an arrow point. This module uses the path planning module and positioning subsystem to guide motor vehicle.

Design of vehicle dynamic optimal path

Intelligent Transportation road network, on one side, the road traffic information can be collected feedback information to make the right road traffic surrounding circumstances, the vehicle can be dynamic optimal path planning, on the other side, real-time traffic information can't be effectively around feedback, travel information management system of the vehicle, the vehicle can only be static path planning of road-vehicle navigation systems; which is the study of scientific research in the field of intelligent traffic engineering hot issues. The Intelligent Transportation Systems are the primary

means of solving traffic problems. Vehicle dynamic path planning is more than the static path planning process to reflect the status of the vehicle's credibility, timeliness and accuracy[8]. Figure 4 : Shows the overall power circuit.

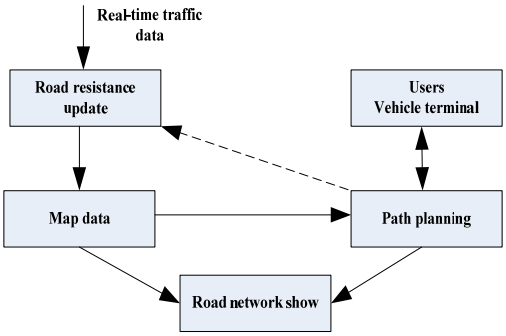

Figure 4 : The overall power circuit

Travelers issue needs to transport network central control system for a vehicle route planning, central process control system based on real-time road traffic information needs, determine the transportation network, dynamic programming the optimal path traveled by the vehicle, and transmit data to the onboard navigation path road network display module. Intelligent transportation network road vehicle display module can set the display by the vehicle traffic around the beginning and end nodes on the network map; and it is able to display the route planning and control system, the calculated optimal path.

Vehicle dynamic path optimization system use the flow of traffic from the traffic information and integrated processing platform combining network topology information, the right travel time is calculated based on the weight of the road, and then use the appropriate algorithm to improve the path optimization. The dynamic traffic equilibrium dynamic optimization uses the information systems to optimize the system for the traveling staff provide guidance information, while providing a balanced traffic guidance strategy for urban transport, information and guidance strategy to induce the dynamic traffic flow equalization system and constitutes the feedback information.

Intelligent traffic information control system

Through networking technology to build the initiative to contact intelligent traffic information system platform and the vehicle terminal, abandon past passively collected information form, information and vehicle information platform for two-way communication between the terminals. Intelligent traffic control system will be based on information collected from the vehicle and traffic information, combined with computer control technology and intelligent algorithm analysis, complete a comprehensive perception of roads and transport, in order to achieve effective regulation of traffic information, and provide convenient services for vehicle users, to achieve full-time traffic control, provide transportation efficiency and traffic safety based networks and applications, making the traffic management in anticipation beforehand disposal into the active management model, but also profound changes in the field of intelligent transportation management system.

User information management module can complete the user's data and owners of rights management. Traffic information control module can obtain comprehensive information for statistical and data management information. On this data, conduct GRF road network information to predict functional way to achieve controlled. Through the computer system's powerful strategic analysis and algorithm tries to data monitoring and management of traffic information and the use of software engineering ideas combined with a powerful platform for the external interface capabilities, research software component of digital technology to achieve information system maps the digital information processing functions. Software component technology successfully applied in intelligent transportation system, not only provides an effective solution for intelligent traffic information control system of digital information processing, but also for future research intelligent transportation system expansion and performance improvements, such as providing a research direction[9].

Intelligent path search module will combine intelligent algorithm cybernetics for policy analysis, complete path search query and response module provides real-time data, the algorithm can be controlled according to real-time traffic information. Serial data transmission module is mainly used to manage data flow, combining RF and wireless sensor network technology networking environment, complete the pre-processing functions to receive, send, and data of the RF data. The module receives the transmitted RF wireless sensor network data can use the data preprocessing functions to extract valid data, and control information and data to the wireless sensor networks. Real-time feedback and positioning module, which will provide a single user terminal vehicle location, traffic information query based on the location of the vehicle

CONCLUSIONS

As an integral part in the industry chain of IOT, intelligent transportation has the characteristics that is highly used in the application market, maturely technological and greatly supported by government, therefore, the introduction of Internet of Things will dramatically change the service model and system architecture of ITS, and the market prospect is broad. In this

paper, traffic guidance and traffic control systems were researched as well as the Internet of Things (IOT). We have established an efficient framework for the IOT, so as to let them choose the best route to travel. Meanwhile, traffic network optimization has been realized to reduce traffic congestion areas. This paper has optimized regional traffic signal control systems based on IOT, traffic guidance as well as traffic assignment, involved data sources, IOT design patterns, data collection as well as the relationship between guidance obeisance rate and traffic jam.

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