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Intelligent Logistics Technology and Big Data Based on Smart City Construction and Internet of Things

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Abstract: The basic idea of the concept of smart city is to use computer information technology to enhance the comprehensive competitiveness of the city. With the rapid development of network information technology, especially the vigorous development of mobile network information technology, it provides data support for the construction of smart cities. This paper studies the intelligent logistics technology and big data of smart city construction and the Internet of Things, and analyzes the relevant theoretical knowledge of the intelligent logistics technology of the Internet of Things on the basis of the literature. The algorithm referenced in the design is tested, and the detection results show that the positioning algorithm in this paper is more accurate than the traditional algorithm, and the positioning error is within 1%.

1. Introduction

In recent years, the dynamic development of Internet of Things technology is an inevitable product of the rapid development of computer technology to a certain extent, and it is also the latest feature of economic and social development [1, 2]. At present, the Internet of Things technology has become an important part of the development trend of China's computer industry. In the Internet of Things, people use signal measurement devices (radio frequency identification, gas sensors, temperature / humidity sensors) to receive and transmit information on the status of various objects, and integrate the entire society into an interconnected network to achieve intelligence [3, 4]. The Internet of Things is a collection of various perception, communication, and computer technologies that not only accelerate the relationship between people and things, but also allow us to program the communication between people and things and between things, enabling society, information space, and the physical world(human-machine-object) integration [5, 6]. Today, political, economic, and technological environments are being created around the world for the development of the Internet of Things. Conditions such as big data, high-tech chips, micro-sensors, cloud computing, and the Internet of Things will become the focus of innovation, and fields such as security, logistics, furniture, environmental protection, and electricity will become the focus of application [7, 8].

In the study of smart Internet of Things, some researchers focus on international logistics research, especially environmental research and green logistics, and the impact of information technology and intelligent transportation systems on the global chamber of commerce. The theoretical research field of logistics industry development, as simple logistics, green logistics, and smart logistics, should be rationally applied and integrated with modern business concepts such as environmental protection and sustainable development. At the same time, it is believed that through the realization of informatization and intelligent management of logistics activities, the optimal allocation of network resources can be realized, and intelligent logistics management can be brought to a new height, thereby realizing efficient e-commerce [9]. Relevant researchers carried out research and analysis on the Internet of Things technology under the global framework of EPC and its application in smart logistics warehouse management, and combined the EPC Internet of Things technology with the wireless sensor network of WSN to solve the complementary problem [10]. To sum up, there are many research achievements on intelligent logistics for the Internet of Things, but the research on related technologies needs further research.

This paper studies the intelligent logistics technology and big data of smart city construction and the Internet of Things, analyzes the composition of the Internet of Things and the status quo of intelligent logistics on the basis of the literature, and then designs the intelligent logistics management system of the Internet of Things, test the algorithms referenced in the design, and draw relevant conclusions from the test results.

2. Research on Intelligent Logistics Technology of Internet of Things

2.1. Composition of the Internet of Things

Starting from the concept of IoT, it can be considered as three spaces [11]. One is the physical space of the actual material of interest, the other is the data space that reflects the properties of this material of interest, and the third is the virtual control space that connects the two. The relationship between the data space and the material space is that the data space can intuitively represent the objective material through the data, and the virtual control space can change some properties of the material space through the data. The relationship between the data space and the virtual control space is a data integration relationship. These three relationships constitute the relationship of IoT knowledge integration. In addition, the level of IoT integration is further divided into three levels:

(1) Real-time multi-source perception data.

In IoT, data is collected through sensors, and each sensor is a source of data [12]. Due to the variety of sensors, including temperature, humidity, noise and other sensors, the content and format of data collected by different types of sensors are different. Therefore, it is necessary to use the Internet of Things data service technology to set a fixed collection rate for each sensor when collecting data, every time new data is collected, the data changes in real time. Therefore, the characteristics of IoT data are real-time and diverse multi-sources.

(2) Organization and management of batch sensory data. In IoT, many sensors need to collect data on a regular basis. To meet a variety of application needs, organizations that collect data must ensure data integrity. At the same time, the continuous growth of data volume will rapidly increase the difficulty of data maintenance, access and use. Finding the data that users need from batch data requires an easy-to-use guarantee.

(3) Effective use of sensory data. The real-time fusion and processing of massive data is the key to the efficient use of data. The angle of data fusion and processing depends on the needs of the application. Therefore, the application of the Internet of Things also has regional characteristics. Every field of social life has the need for the application of the Internet of Things. But at the same time, IoT applications between various industries have also appeared, such as sensor equipment for various objects such as roads, buildings, dams, power networks, high-speed railways, tunnels, water conservancy systems, roads and bridges, and oil pipelines. To complete the integration between human society and physical systems, the "Internet of Things" must be integrated with the current

network environment. With the advent of the Internet of Things era, people hope to quickly obtain Internet of Things data and information through the Web, and observe the data in real time to make accurate decisions.

2.2. Current Situation of Logistics

The modern logistics system is a complex and huge system, involving all aspects of social life, more specifically, involving raw material suppliers, producers, wholesalers, retailers and other links, which is the entire market process. Information system plays a very key role in modern logistics. The information system forms the central nervous network system of modern logistics. With the help of the rapid, accurate and real-time circulation of information in the modern logistics system, the company can respond to the market independently, thus forming a virtuous circle of business, information and capital circulation.

The relationship between logistics and information is closely related. First, a large amount of data will be generated in logistics activities, such as the supply of raw materials and the loss of finished products. Second, the continuous progress of information technology provides necessary conditions for more effective and large-scale information exchange, so that the scope of logistics business can be expanded, and the organizational management form, logistics function and efficiency level of logistics can be continuously improved. Third, the development and implementation of the latest communication and network technologies make it possible to exchange and transmit information between regions in a timely manner.

Due to the large amount of information in the logistics industry, the fast information update, and other functions, logistics information is essential, and the backward logistics information technology limits the development of the industry. At present, many domestic companies provide information technology and logistics software that meet the needs of the Chinese market to a certain extent, but due to the high price and low recognition of commercial information, product promotion and use, and the narrow scope of IT. Therefore, the popularization of logistics information technology cannot meet the specific needs of my country's logistics development.

3. Design of Logistics Management System Based on IoT

3.1. Overall Structure Design

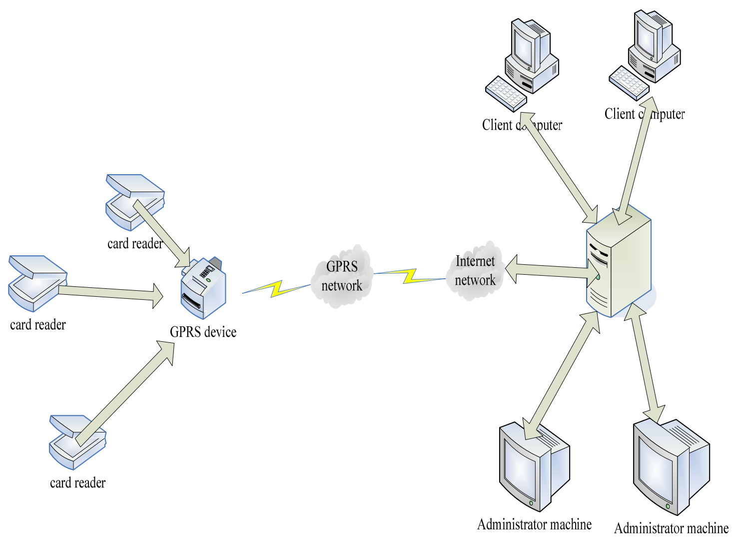

Figure 1: System overall structure design

The logistics system of the Internet of Things is mainly composed of the following three main parts. The first part is all RFID readers in all locations of the distribution company. The second part is the remote transmission unit of GPRS and gateway. The third part is the network and application model of the logistics system using ASP.NET. Figure 1 shows the basic architecture of the entire system.

3.2. Application Level

The application layer designed in this paper includes field subsystem, vehicle subsystem, enterprise logistics subsystem and industry management subsystem. A physical installation and management system for exchanging information between business subsystems. The difference between the business systems of logistics companies lies in the different ways of logistics subsystems, so the subsystems required by logistics companies are different systems of operating systems, so they need to be able to communicate with traffic management departments, fleets, logistics transfer points, airport stations, railways, banks, insurance, taxation and other logistics companies to form information exchange between these intersecting departments and businesses.

3.3. Perception Level

Perception-level roles include user information, employee information, administrator information, product information, and other information about personnel, products, and environments of the intelligent logistics platform that may involve databases or servers, which are uploaded through technology. The identification level of the intelligent logistics system mainly includes the data collection level and the access level. The data acquisition layer mainly transmits offline data information to mobile devices or computers through devices and equipment equipped with sensor technology, barcode identification technology, radio frequency identification technology, and sensors, linear RFID codes, labels and other acquisition functions, and then passes the access level. Network upload function to send it to the global IoT network using networks such as mobile network, wireless network and wired network.

3.4. Design of Database Table Structure

Database design is a very important part of the whole system, without accurate and efficient data, the value of the whole system will be lost. A complete and orderly database structure allows the designed system to run smoothly without causing logical confusion or confusion. The system database designed in this paper is divided into three tables. The first table is the user information table, the second table is the product information table, the third table is the product location information table, the following is the design of the three tables.

3.4.1. User Information Sheet

The user information table is a table that confirms the principle of user login, and can be associated with the user information table through the login interface. When the user logs in, the operating system takes the user information in the login page as the database query condition, and queries the connection of the information from the database user information list, user information form includes ID, username, password and email.

3.4.2. Product Information Sheet

The product information table is the most important in this system, and this table is basic in both the logistics management site management system and the application management system. The system host interface is required for table information when entering a query for each query. According to the search conditions, the product information table is searched through SQL statements, and all data that meets the conditions are returned and displayed in the relevant interface of the corresponding table.

3.4.3. Product Location Information Sheet

After the logistics company receives the goods, it scans the registration information and stores it in the database. First, the current location information of the product is stored in the product information table, and the data is also stored in the destination of the product information table. If the product information changes at this time, the current position of the product information table changes. At this point, the dataset is added to the transit area of the cargo location table and the time to destination is recorded. The main purpose of this table is to record all logistics areas and the times when goods pass through.

3.5. MDS Positioning Algorithm

MDS-based positioning calculation through MDS calculation, the calculation formula of unknown node positioning can be obtained, and the estimated value of positioning can be calculated by least squares. The algorithm is mainly applied to the identification of nodes in a two-dimensional plane environment.

The specific steps to solve this placement algorithm are as follows:

Create a squared distance table D.

Copy D, that is, multiply the center array J on both sides of D at the same time to define J.

$$J = E - (n+m)^{-1} \cdot I \tag{1}$$

Among them, E is an (n+m)-dimensional identity matrix, and I is an (n+m)-dimensional all-one matrix. The matrix H after double centering is:

$$H = -\frac{1}{2} JDJ \tag{2}$$

Unique value decomposition of H.

Based on the known information such as the initial position value of the unknown node, the position of the anchor node, and the distance between points measured by the TOA value domain technology, a positioning model is established based on the extension of Taylor's multivariate series.

$$D = Q\Delta + E \tag{3}$$

4. Algorithm Test

To test the validity of the latest MDS-based tracking calculation, this chapter also simulates the calculation through MATLAB and compares it with the MDS and MDS algorithms of the traditional Taylor series extended model. The simulation parameters are that 30 sensor nodes are randomly and uniformly distributed in the simulation area of 200mx200m, and 1500 simulations are performed independently. The distance measurement errors are assumed to follow a Gaussian distribution with zero mean and zero variance. In order to evaluate the positioning efficiency of the positioning algorithm, it is represented by the root mean square error (RMSE). The experimental results are shown in Table 1:

Table 1: Algorithm test results

	Traditional MDS algorithm	A New Algorithm Based on MDS
0.5	1.1	0.4
1	1.4	0.5
1.5	1.6	0.7
2	1.8	0.8
2.5	2.2	0.9
3	2.4	1

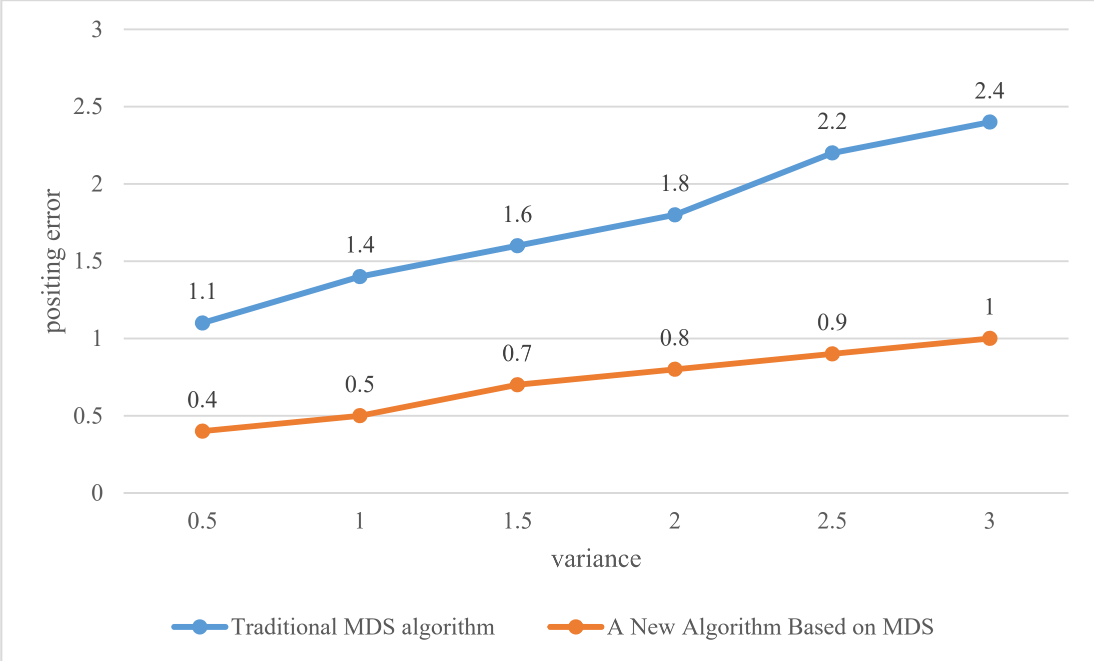

Figure 2: Algorithm test results

It can be seen from Figure 2 that the positioning errors of both algorithms increase with the increase of the distance measurement error, but the positioning error of the new algorithm is significantly lower than that of the traditional algorithm.

5. Conclusions

This paper studies the intelligent logistics technology and big data of smart city construction and the Internet of Things. After analyzing the relevant knowledge theory, the intelligent logistics management system based on the Internet of Things is designed, and the algorithms referenced in the design are tested. The detection results show that the positioning errors of the two algorithms increase with the increase of the distance measurement errors, but the positioning errors of the new algorithm have a significant decrease compared with the traditional algorithms.

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