Intelligent Logistics Supply Chain Management Based on Internet of Things Technology

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***Abstract*—Supply chain management refers to the logistics management between enterprises, which involves coordinating the design and operation of the entire chain, including suppliers, manufacturers, wholesalers and retailers. Implementing the system concept of integrated supply chain management is a research hotspot. The purpose of this paper is to study the application of intelligent supply chain management based on Internet of Things technology. Mainly take the drug supply chain as the research object, and apply the Internet of Things technology to drug transportation. The first is to analyze the traditional supply chain system to determine the supply chain's demand for IoT technology and wireless technology; the second is to rationally optimize the various processes in the supply chain management system, and make its function realization practical. The experimental results show that compared with the original distribution logistics system, the optimized scheme saves 12.8% of the cost. Finally, the framework and structure of the medical supply chain system based on the Internet of Things technology are established, and the implementation and application are analyzed.**

Keywords—internet of things technology, intelligent logistics, supply chain management, management application

I. Introduction

With the continuous development of supply chain management and the complexity of different logistics information, enterprises need logistics information, and the evolution of network technology provides technical support for logistics information [1]. The rapid development of the Internet of Things and computers has brought the whole society into the information age, and the logistics system has developed rapidly [2]. In recent years, many companies have integrated IoT technology into supply chain management platforms and achieved amazing results, making managers aware of the importance of IoT technology and beginning to pay attention to logistics management applications [3].

At present, scholars' study and research on logistics service supply chain related knowledge is still in the stage of continuous development [4]. Kain R provides an overview of Logistics/Logistics Management in Supply Chain and its current logistics related issues in business and presents a conceptual approach to related issues. The logistics-based methodology is the input and output of the methodology. A literature review is conducted on key external and internal issues of logistics and industrial logistics issues to identify their various dimensions. Based on the insights obtained, a conceptual approach to logistics problems is proposed [5]. AGMabengmensah Y studies the relationship between information technology, supply chain quality integration, green logistics management and organizational performance. The intermediary role of supply chain quality integration and green logistics management is further investigated. It is found that supply chain quality integration and green logistics management play a mediating role between information technology and organizational performance. In addition, the findings suggest that supply chain quality integration plays a mediating role between information technology and organizational performance [6]. To provide customers with comprehensive and flexible services is the central idea of the current and future development trend of the logistics service supply chain. In order to provide high-quality services and make the supply chain operate efficiently, it is essential to conduct research on capacity coordination [7].

This paper analyzes the application of IoT in numerous supply chains, providing a solid technical foundation for the design and optimization of GW, including technical expertise in logistics information systems, supply chain management, infrastructure, Internet, and RFID radio recording. Manage technical tools such as artificial intelligence, architectural algorithms, analog circuit testing, cloud computing, including smart logistics. After on-the-spot inspection of GW, the construction and simulation of inventory management model, transfer operation model, storage operation model and performance operation model, as well as various situations that may occur in GW's stock purchase process, are carried out for system optimization and intelligent logistics system. The construction provides theoretical data. Through the simulation of different stages of the GW operation connector, briefly discuss the technical issues and possible integration processes, and make technical preparations for the overall construction of the IoT logic system.

II. Research on the Application of Intelligent Logistics Supply Chain Management Based on Internet of Things Technology

A. Internet of Things

The Internet of Things can be literally understood as "Internet of Things" [8]. Essentially, the Internet of Things is a broad network built on the Internet, based on the Internet today, and further based on the realization of full connectivity; the Internet of Things has social media services that can be exchanged and spread. Identify information, phenomena of communication between focus and objects [9].

Generally, an RFID software system consists of two

main components: an electronic tag reader and an RFID card. Among them, the card reader is used as a computer for reading, writing and storing RFID card information. It has a control, high-speed communication unit and antenna, while the RFID card is a transponder. It consists of an orbital (IC) and an external antenna [10]. RFID chips often contain RF-internal, intelligent control, memory and other obstacles, and some even connect the antenna to the same chip [11].

The basic premise of the RFID software system is that after the RFID card enters the reader line radio, from its antenna like a chip light, it passes through the amplifying circuit, along with information and analog information [12]. It is identified by the RF front to receive solid signals. They are sent to the same checkpoint to process the information; the information that needs to be returned is found in memory, sent through the smartwatch to the first RF channel, and then sent back to the reader through the antenna.

B. Application Analysis of Internet of Things in All Links of Supply Chain

(1) Raw material procurement link

Through the Internet of Things, supply and demand information can be communicated in real time, making resources and information available. Suppliers respond quickly to the market. The seamless connection of information between manufacturing enterprises and spare parts suppliers provides conditions for the smooth progress of production and promotes the operation of the supply chain better and faster.

(2) Production link

In the manufacturing process, the Internet of Things technology, automation automation technology and positioning technology are used to identify and track the items on the entire production line, find the bulk items called by the power of the display, and a large number of raw materials and blind parts are available. Market and labor costs Reduce labor costs and error rates, increase automation and simplify production for offline production. In addition, it can also help the production manager to adjust the production schedule in time according to the customer's needs, as well as adjust the production schedule or send the repair report information in time, avoid delays and the loss of delayed materials, and realize the balance, stability and production process of the production line.

(3) Transportation link

During transportation, checkpoints (transit warehouses or temporary transit stations) are set up in the transportation mode, and RFID receiving and forwarding equipment is installed to identify the goods and EPC signals on the goods. Both the manufacturer and the user can clearly understand the current location and location of the goods when they are transported. Real-time tracking of the transfer process, traders cannot accurately judge the number of goods at the intersection, the start and end of the journey, the arrival time and other transportation information to ensure correct inventory control, and automatically compare the data collected by each scanner with the delivery information, without the need for simulated inspections and statistics, which can not only prevent the loss of goods, but also prevent malicious fraud and collusion, and effectively manage and regulate products.

III. Investigation and Research on the Application of Intelligent Logistics Supply Chain Management Based on Internet of Things Technology

A. Basic Information of the Company

GW Corporation is a private subsidiary of a central government subsidiary. It is the logistics hub for GMWL, a leading third-party pharmaceutical and medical device logistics provider. It was the first company in the M region to receive a modern third-party pharmaceutical certification. The company provides professional logistics solutions for pharmaceutical companies, pharmaceutical distributors, medical device distributors and other customers, including a scientific management system, rich industry experience, the improvement of information tools, and a high-quality and efficient logistics team such as logistics materials.

B. Management System Design

The logistics information management system, as a sample program running on the Internet of Things application platform, is a demonstration application program with relatively simple functions. But it also combines sensor technology and RFID technology commonly used in Internet of Things technology, and uses the API provided by the platform to complete functions. It has three functional modules: traceability information query module, warehouse information query module, and loading and unloading management module. This module basically covers the main information in the logistics process. The detailed steps for setting up the application development environment are:

Install JDK (Java Development Kit) and configure environment variables.

Create a new folder named Android on the hard disk, open the Android official website to download the compressed package adt-bundle-xxxxxx.zip, export it to the Android folder, and then create a new workspace folder.

Run eclipse/eclipse.exe, set workspace as a new folder, and click OK.

At present, Android applications can be developed, and there is no problem in creating simple applications such as HelloWorld.

In addition, you may need to run Windows->SDK Manager to manage the SDK. In the SDK Manager window, Google USB Driver is checked by default, and its function is to allow developers to use real Android phones to debug and run applications.

C. The Optimal Distribution Planning Model of the Optimization Scheme

Assumption 1: Goods can be shipped from the supplier, the logistics center in province M and the logistics center in province B to each distribution center;

Assumption 2: The model considers that only one supplier distributes a drug to GW

Assumption 3: 0.5 days means that it can be delivered on the same day or the next morning, and can be ignored when considering inventory holding costs;

Assumption 4: The supplier has sufficient supply and there is no shortage of stock;

Assumption 5: The distribution and delivery are carried

out under the condition that both the logistics center in province M and the logistics center in province B have goods;

Assumption 6: No consideration of site rent or land purchase cost.

make:

The number of pieces of medicine from the supplier to each distribution center is Xi;

The number of medicines from the logistics center in province M to each distribution center is yi;

The number of medicines from the logistics center in province B to each distribution center is Zi;

The maximum storage capacity of the drug in the logistics center of M province is A;

The maximum storage capacity of the drug in the logistics center of province B is B;

The transportation cost and holding cost of M province to each distribution center are ai;

The transportation cost and holding cost of the shipment from province B to each distribution center are bi;

The transportation cost of the supplier's shipment to each logistics center and distribution center is di;

The local demand is qi. The optimal distribution planning model is:

$$\min C_2 = \sum_{i=1}^{12} a_i y_i + \sum_{i=1}^{12} b_i z_i + \sum_{i=1}^{12} d_i x_i \quad (1)$$

Restrictions:

$$\begin{cases} \sum_{i=1}^{12} y_i \le A \\ \sum_{i=1}^{12} z_i \le A \\ \sum_{i=3}^{12} (x_i + y_i + z_i) \le q_i \\ x1 + y1 + z1 = q1 + \sum_{i=1}^{12} y_i \\ x2 + y2 + z2 = q2 + \sum_{i=1}^{12} z_i \\ x_i \ge 0, y_i \ge 0, z_i \ge 0 \end{cases} \quad (2)$$

IV. Analysis and Research on the Application of Intelligent Logistics Supply Chain Management Based on Internet of Things Technology

A. Comparison of the Two Schemes of Logistics and Distribution

The original logistics distribution scheme studies its optimal distribution mode considering the transportation cost and the holding cost required for distribution from two logistics centers to various places. GM logistics company now requires suppliers to send medicines to province M and province B, and then deliver the medicine through the logistics center in province M and province B. The logistics center in province M has a maximum inventory capacity of 15,000 pieces of this medicine, and the logistics center in province B The maximum inventory capacity for this drug is 10,000 pieces. Only the transportation cost from the logistics center in Province M and the logistics center in Province B is considered, and the transportation cost of the supplier to the two logistics centers is not considered. The cost of the supplier's shipment to the two logistics centers is 5 yuan per piece.

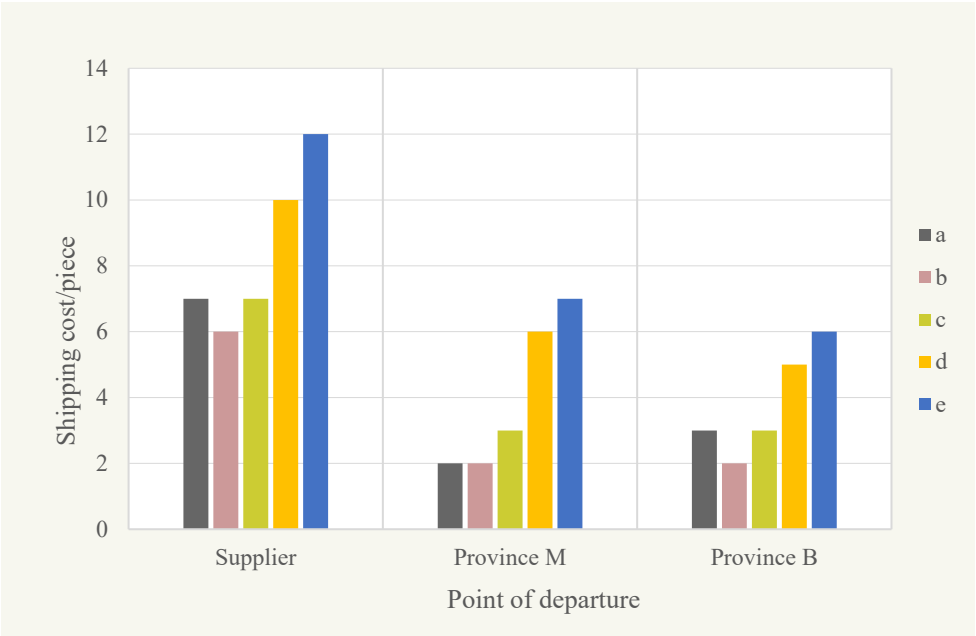

Figure 1. GM considers supplier transportation costs

Considering the cost of inventory holding and direct delivery from suppliers, there is an overall cost advantage, especially for distribution centers that are far away from the logistics center. Through the way of direct delivery from suppliers, it not only reduces the number of inventory turnover days, but also reduces transportation costs. At the same time, the plan considers that the two logistics centers have the advantage of collecting and delivering goods, so that the medicines of each supplier can be sent to the distribution center in a unified manner. If there is no transportation cost advantage and the holding cost is the same, it can be considered from the logistics center in province M or B. For delivery from the provincial logistics center, GM considers the supplier's transportation cost as shown in Figure 1.

That is, the shipments from suppliers, logistics centers in province M and logistics centers in province B are shown in Table I:

TABLE I OPTIMAL TRANSPORTATION TABLE AFTER OPTIMIZATION BY GM (UNIT/PIECE)

Xi	X1	X2	X3	X4	X5
Solve results	8765	0	0	0	7654
Yi	Y1	Y2	Y3	Y4	Y5
Solve results	0	0	0	1454	0
Zi	Z1	Z2	Z3	Z4	Z5
Solve results	0	3455	1549	0	0

Comparing the total cost of the two schemes before and after, the optimized scheme reduces the inventory holding cost by reducing the inventory holding time of GM company, and also reduces the transportation cost of the supply chain due to the overall transportation. The above optimization scheme saves 12.8% of the cost compared to the original scheme. Inventory is directly sent to each distribution center through suppliers, which makes more efficient use of GM's overall storage capacity and personnel operating costs, and reduces the related labor waste caused by repeated operations.

B. Logistics Information Management System

The home page of the logistics information management system is mainly used as a guide for the three major functions of the system. Click the logistics information system program button on the Internet client business interface of the installed Internet of Things application platform to start the business program. The home page wizard function is very simple, so the structure is also very simple. Draw three buttons to enter three functions respectively. However, before each business plan enters the home page, it is necessary to identify the main program called by the business program, verify that the main program is safe, and verify whether the main program login user has the right to call the business program. So the homepage should have two main parts, one is the main program identification module, and the other is the driver module of the homepage itself. As shown in Figure 2.

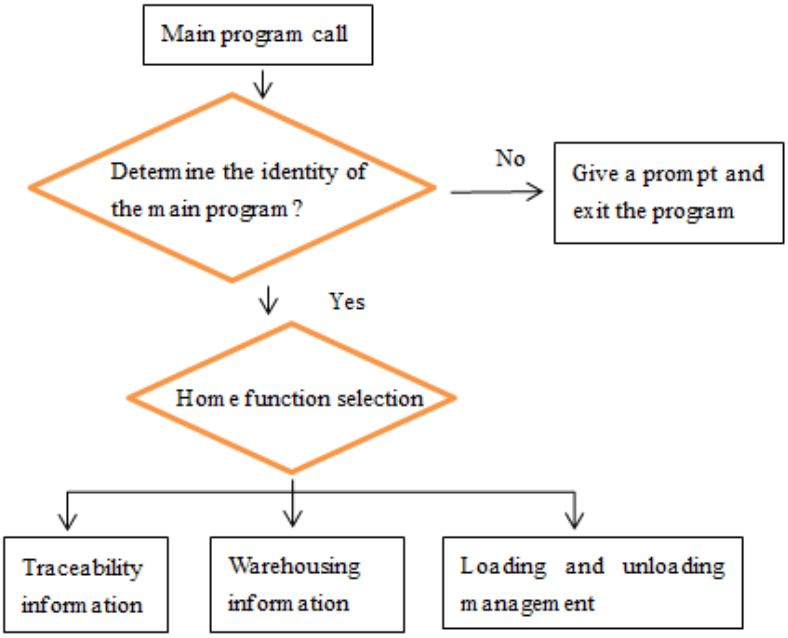

Figure 2. Homepage function of logistics information management system

In the logistics information management system, each item to be transported is pasted with an RFID tag, and the identification code of the RFID tag is used as the unified number of the item. In order to facilitate the entry of the item number on smart devices with a camera scanning function such as mobile phones, the uniform number of the item can be made into a QR code label and attached to the item, and the mobile phone can use the camera to scan the QR code label to obtain the uniform number of the item.

Vehicles and warehouses are also numbered uniformly for management, and their uniform numbers can also be recorded by QR codes.

V. CONCLUSIONS

IoT technology can track and manage all the data in the world. This feature is designed to make IoT shine in logistics management systems. How to introduce IoT technology into supply chain management has become the focus of many scholars. This paper introduces the logistics of the Internet-based pharmaceutical supply chain, mainly from supply logistics, manufacturing logistics, sales logistics and

marketing logistics, and compares the original logistics methods and trade logistics methods. From the basic knowledge, system architecture, system implementation and main functions of the logistics integration platform, the Internet-based IoT automotive supply chain logistics integration platform is analyzed.

REFERENCES

[1] Queiroz M M, Telles R. Big data analytics in supply chain and logistics: an empirical approach. The International Journal of Logistics Management, 2018, 29(2).

[2] Lai Y, Sun H, Ren J. Understanding the determinants of big data analytics (BDA) adoption in logistics and supply chain management: An empirical investigation. The International Journal of Logistics Management, 2018, 29(2).

[3] Ali S M, Arafin A, Moktadir M A, et al. Barriers to Reverse Logistics in the Computer Supply Chain Using Interpretive Structural Model. Global Journal of Flexible Systems Management, 2018, 19(MAR.SUPPL.1):1-16.

[4] Tu M, Ming K L, Yang M F. IoT-based production logistics and supply chain system – Part 2. Industrial Management & Data Systems, 2018, 118(1):96-125.

[5] Kain R, Verma A. Logistics Management in Supply Chain – An Overview. Materials Today Proceedings, 2018, 5(2):3811–3816.

[6] AGMabengmensah Y, Ahenkorah E, Korsah G. The Mediating Roles of Supply Chain Quality Integration and Green Logistics Management Between Information TechnoloGM and Organisational Performance. Journal of Supply Chain Management Systems, 2019, 8(4):1-17.

[7] Sitikarn B, Kankaew K. Community based tourism logistics supply chain management in the top north of Thailand: A key linkage to the greater Mekong subregion. Uncertain Supply Chain Management, 2021, 9(4):983-988.

[8] Paciarotti C, Torregiani F. The logistics of the short food supply chain: A literature review. Sustainable Production and Consumption, 2021, 26(2):428-442.

[9] Gupta S, Haq A, Ali I, et al. Significance of multi-objective optimization in logistics problem for multi-product supply chain network under the intuitionistic fuzzy environment. Complex & Intelligent Systems, 2021, 7(4):2119-2139.

[10] Jian L. Optimal design of transportation distance in logistics supply chain model based on data mining algorithm. Cluster Computing, 2019, 22(1):1-10.

[11] Qu Y, Bossman M. Logistics and Supply Chain Management Efficiency StrateGM for Ghana's Mining Industry. European Journal of Business Management and Research, 2021, 6(2):193-202.

[12] Ivkovi A, Franjkovi J, Dujak D. The role of organizational commitment in employee turnover in logistics activities of food supply chain. Logforum, 2021, 17(1):25-36.