Design of Agricultural Products Intelligent Transportation Logistics Freight Forecasting System Based on Large Data Analysis

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Abstract. The traditional forecasting system of agricultural products transportation logistics cargo flow relies too much on people's subjective experience in forecasting, and the forecasting results are not accurate enough. To solve this problem, based on the large data analysis, a new forecasting system of agricultural products transportation logistics cargo flow is studied. The hardware and software parts of the system are designed, the hardware of the system consists of five parts: data collector, data analyzer, matcher, processor and tracer. The internal composition of each construction is described accurately. The working process of software is information input, information analysis, information matching, information processing and information tracking. The software workflow diagram is given. The results of the system are validated by comparing with the traditional cargo volume prediction system. The experimental results show that the system has high intelligence and can accurately predict the volume of goods transported in a short time. It has important guiding significance for the development of agricultural products transportation.

Keywords: Big data analysis · Transport of agricultural products · Intelligent transportation · Logistics cargo flow · Cargo flow forecasting · Prediction system

1 Introduction

With the development of information technology, the whole world has entered the information age, and the big data information has been penetrating into people's lives. Big data is huge data, it refers to the huge amount of information involved, which can not be captured, managed, processed and collated in a reasonable time through the current mainstream software tools to help enterprises make more positive business decisions. That is, "massive and complex data sets cannot be extracted, stored, searched, shared, analyzed and processed with existing software tools". With the arrival of the era of big data, information technologies such as Internet of Things and cloud computing will be widely used in the development of agricultural logistics, and become an important factor to break through the information bottleneck of agricultural logistics integration [1].

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On the basis of large data analysis technology, this paper constructs an integrated model of agricultural products logistics and studies an effective freight flow forecasting system of transport logistics. The hardware and software of the system are dissected systematically and thoroughly. The composition of the system's logistics collector, analyzer, processor and tracker is studied. The software workflow of the system is designed and compared with the traditional system. Through the research of this paper, we can know that the system can realize the integration of agricultural products logistics in a real sense, it is the integration and systematization of the supply chain of agricultural products production enterprises through logistics enterprises, sales enterprises and consumers, including a series of links such as agricultural products production, acquisition, transportation, storage, loading and unloading, handling, distribution, circulation and processing, distribution and information activities. Through Internet of Things, cloud computing and other information technologies, the massive data are cited in the production, procurement, transportation, storage, distribution, sales and other links of agricultural products, Promoting the synergy and integration of logistics, integrate logistics information and technology organically to complete the process of monitoring the whole cold chain logistics [2].

Intelligent transportation of agricultural products for the application of large data is mainly through the global positioning system, radio frequency technology and two-dimensional code scanning and other advanced information technology from the agricultural products logistics system to capture, collect, integrate and match logistics information, stored in the public database, in order to maintain data integrity, real-time and accuracy [3]. Meanwhile, Logistics management information system processes, analyses, processes and utilizes these information through logistics information management platform to form valuable logistics information of large data agricultural products supply chain.

2 Hardware Design of Agricultural Products Intelligent Transportation Logistics Freight Forecasting System Based on Large Data Analysis

Based on large data analysis technology, a high-performance intelligent transportation logistics cargo volume prediction system is designed. The hardware of the system consists of five parts: data collector, data analyzer, matcher, processor and tracker. The overall design framework of the hardware part of the system is shown in Fig. 1 below [4]:

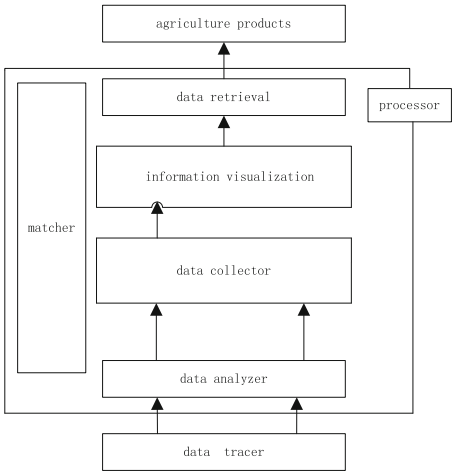

Fig. 1. Hardware framework of agricultural products intelligent transportation logistics cargo volume prediction system based on large data analysis

2.1 Data Acquisition Device Design

The 16/32-bit Chipest 156 chip developed by Camed Logic Company in UK is selected as the internal part of the data acquisition device designed in this paper. The core logic of the chip is RIC structure. Arounding the microwave processor, there are 36 internal interfaces (20 TEA interfaces, 16 UEA interfaces), 40 external interfaces (20 MMY interfaces, 20 MMU interfaces) GPS. When the receiver works, the input voltage should be above 220 V and the power supply frequency should be between 50 MHz and 120 MHz. At the same time, the core programming system should be connected to scan the GPS signal with embedded ICE [5]. GPS signal receiver can receive all kinds of signals, such as language, text, image, data, and so on. With the help of computer terminal equipment, the obtained signals can be transformed into electrical signals and screened simply, including coding, modulation, amplification or transmission.

2.2 Data Analyser Design

The analysis signal in the data analyzer is the long distance and large capacity radio communication signal. The frequency bandwidth occupied by the transmission signal, microwave and ultrashort wave bands can complete the work, but the microwave processing effect is better. Data analyzer uses ARM11 processing chip developed by ARM company, which can connect several data together and has stable processing characteristics in the range of sight. But if we want to deal with long-distance communication signals, we need to use relay (also known as relay) communication signal processing mode, which is connected through various relay stations, and the processing range is as high as 20–50 km. Microwave processor can process both analog and digital relay communication signals. It has very good encryption ability and is very convenient for later transmission. Therefore, people pay more and more attention to it [6].

2.3 Data Matcher Design

The core chip of the data matcher is the CEDA chip developed by IBM, this chip can transform baseband signal into a form suitable for transmission in the transmission medium. It can be transmitted through the transmission medium. At the receiving end, it can be inversely transformed by the receiving device to restore the message to the recipient. The selected matching mode is bidirectional transmission with very short working delay, usually between 2 and 5 micros. The area of CEDA chip is very small, so it will not consume too much power and produce noise pollution. This is incomparable with other current chips in the market According to the matcher, the starting and receiving devices are installed on both ends of the matched object, which greatly improves the transmission efficiency.

2.4 Data Processor Design

The processor is a S3C2440A microprocessor manufactured by Samsung. The core of the processor is 32 bits, It can not only bring the advantages of ARM920T into full play, but also bring MMU, AMBA and Harvard structure to realize high-speed buffer. There are independent instruction Cache and data Cache in the processor. The instruction Cache size is 32 KB and the data Cache size is 64 KB. It can connect the peripheral interfaces of other hardware devices at the same time and complete encryption through I/O mode. The highest frequency of S3C2440A microprocessor can reach 600 MHz [7].

The processing system is shown in Fig. 2:

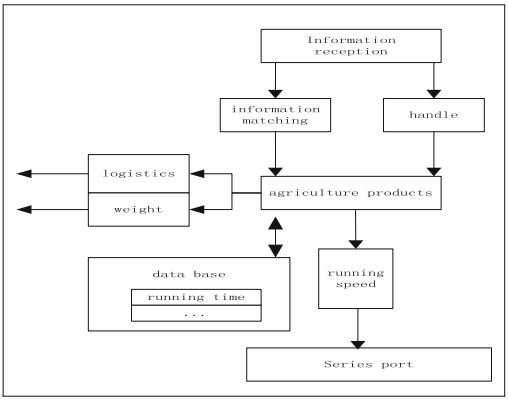

Fig. 2. Data processing system

The network used in the data processing system in Fig. 2 is the Resistance Capacitance (RC) network, the network can generate suppression waves from the load side to prevent interference signals from entering. The RC network connected at both ends of the load can effectively reduce the interference amplitude. Varistors are used to block interference signals in DC and AC circuits. As a non-linear resistor device, varistors are highly sensitive to voltage. In terms of characteristics, it is very similar to

bi-directional voltage regulator, with non-polarity, symmetry, non-linearity and inductance suppression, so it is suitable for both DC and AC circuits [8]. Varistor has many advantages, such as small temperature coefficient, wide voltage range, long service life, small occupied area, low consumption cost, etc. Therefore, it is placed on multiple contacts and coils in the hardware system designed in this paper.

2.5 Data Tracker Design

In order to check whether the prediction result of the prediction system is accurate, a data tracker is set up. The terminal node of the tracker chooses a small EGB control chip. This chip follows the latest Internet protocol, IEEE 802.15.4. It integrates the RF front end and the controller core. It can simultaneously control the water temperature sensor, water level sensor, PH value sensor and dissolved oxygen sensor, and detect the collected parameters. The volume of EGB control chip is very small, and the internal power supply voltage is limited. Therefore, the design of hardware should follow the standard of energy saving and achieve the maximum efficiency in the shortest time. As a regulating node, gateway node has self-coordination and powerful data processing ability. The processed data are stored in the database for follow-up work. Because of the different environment of the underwater channel monitored, the emphasis of selection is also different. When monitoring, the gateway nodes should be isolated and set separately to prevent the interference between different sensors and other signals from being transmitted to the system under test. Gateway nodes use physical addresses of terminal nodes to divide signals. When new instructions are input, the system list will increase continuously and new commands will be determined at the same time. The number of gateway nodes is small, so the power consumption is very small, and there are many communication modes that can be selected, For example: Internet communication, satellite communication and mobile communication, etc. There is only one central gateway node and many edge nodes, which are responsible for the relay and forwarding of data signals [9]. The gateway node circuit diagram is shown in Fig. 3:

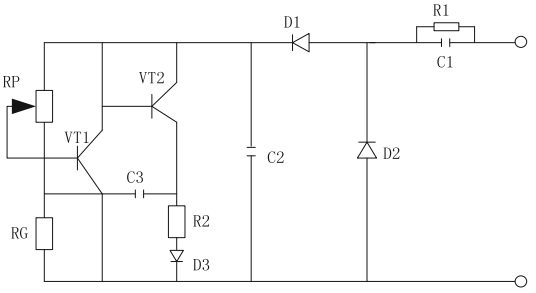

Fig. 3. Tracker gateway node circuit diagram

The central monitoring node is the central part of the monitoring system. It can fuse the information collected by each sensor together, and then analyze it. According to the analysis results, the specific image of the underwater channel of the ship can be drawn.

The central monitoring node has the functions of data processing, visualization and management. The central monitoring node based on wireless sensor network also has remote control function. The hardware composed of large-scale disk array has excellent performance. It can not only monitor the underwater channel in real time, but also monitor the underwater channel actively.

3 Software Design of Agricultural Products Intelligent Transportation Logistics Freight Forecasting System Based on Large Data Analysis

The hardware part of agricultural products intelligent transportation logistics cargo volume forecasting system based on large data analysis is designed. The working process is shown in Fig. 4 below:

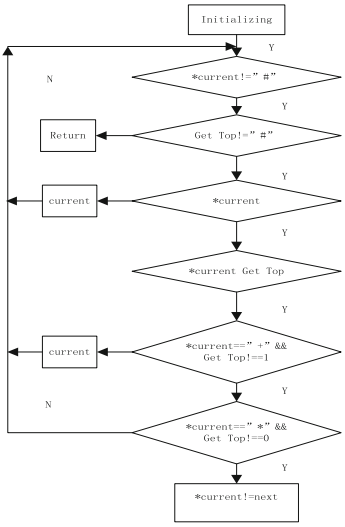

Fig. 4. Software of agricultural products intelligent transportation logistics cargo volume prediction system based on large data analysis

Figure 4 uses big data analysis technology to forecast the logistics flow of agricultural products in intelligent transportation. The specific process is explained as follows: (1) Information input. The central monitoring node sends out control instructions from a long distance, transfers them to the gateway node, and inputs the collected crop logistics information. (2) Information analysis. The central gateway node of the gateway node activates the internal line to accurately analyze the collected crop information. (3) Information matching. The crop information is matched with the agricultural product transportation logistics flow in the database, and the matching results are obtained. (4) Information processing. Processing matched crop information.

(5) Information tracking. When tracking the information of agricultural products, the information tracking software should pay attention to the location of agricultural products, and the results obtained by the terminal nodes should be fed back to the map, so that the staff can better grasp the overall situation of agricultural products transportation. Because the transport environment will change with time, it is necessary to establish a time baseline, draw a map, and analyze the reasons for the change, so as to prevent possible problems in time [10].

4 Experimental Test and Analysis

In order to test the validity of the forecasting system of agricultural products intelligent transportation logistics flow studied in this paper, a comparative experiment was designed to compare with the traditional forecasting system.

4.1 Design of Experimental Parameters

The experimental parameters are shown in Table 1 below.

Table 1. Setting of experimental parameters.

Parameter	Numerical value
Voltage value of I/O module	220 V
Output frequency	55 MHz
Output current	20 A–50 A
Input current	50 A–100 A
Working mode	Ericsson
Working hours	1 h

4.2 Experimental Results and Analysis

The experimental results of prediction accuracy are shown in Fig. 5 below:

Figure 5 shows that when the transport flow of agricultural products is 50 kg, the accuracy of traditional system is 91.0%, and that of this system is 94.8%, when the transport flow of agricultural products is 100 kg, the accuracy of traditional system is 88.7%. The prediction accuracy of this system is 86.1%. When the transportation flow of agricultural products is 150 kg, the prediction accuracy of traditional system is 88.4%, and that of this system is 95.2%. When the transportation flow of agricultural products is 200 kg, the accuracy of traditional system is 88.2%, and that of this system is 96.1%. When the transportation flow of agricultural products is 250 kg, the accuracy of traditional system is 86.0%, and that of this system is 96.1%. When the transport flow of agricultural products is 300 kg, the accuracy of traditional system is 85.3%, and that of this system is 94.5%.

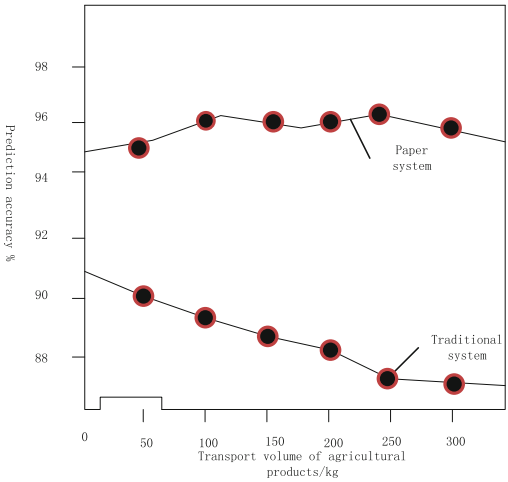

Fig. 5. Prediction accuracy test results

4.3 Experimental Conclusions

According to the above experimental results, the following conclusions can be drawn: both the traditional forecasting system and the forecasting system in this paper can predict the transport logistics cargo flow of agricultural products, However, the traditional system takes a long time to predict, and the accuracy is very low. With the increase of cargo flow, the prediction ability is getting worse and worse. The system studied in this paper is intelligent, can accurately analyze the cargo flow, and the prediction accuracy is always maintained at a very high level.

5 Concluding Remarks

Based on the analysis of large data, this paper designs a forecasting system for the flow of agricultural products in intelligent transportation logistics, which has high forecasting ability and can effectively improve the quality and safety control of agricultural products in logistics integration. In order to improve the quality of agricultural products in an all-round way, the Internet of Things intelligent traceability system should be used to collect relevant data sources, and a large data center for traceability of agricultural product quality and safety information should be established to link the information of agricultural product production and logistics and form a set of information traceability chain. Through this kind of traceability chain, the information of agricultural products can be obtained from the producer or even the specific growing land to the wholesaler or retailer, or from the wholesaler or retailer to the production site, and the positioning analysis of large data can be achieved, so as to make a breakthrough in the supervision of agricultural product quality and safety, and give full play to the logistics function based on big data.

Acknowledgments. Agricultural Science Research Plan in Shaanxi Province of China: "Research on key technologies and applications of Smart agriculture planting and logistics distribution based on the Internet of Things" (NO. 2017NY132).

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