

Research on Agricultural Products Cold-Chain Logistics of Mobile Services Application

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Abstract. Real-time monitoring of agricultural products cold-chain logistics and transport can effectively ensure the quality and safety of agricultural products, reducing logistics cost. This paper analyzes three functional architectures, including the agricultural application of mobile terminal data acquisition, logistics warning and mobile payment. The cold-chain logistics of mobile service application system process and module structure are designed on the basis of the hardware environment of mobile device and wireless network environment. The system can monitor and manage the process of storage and transportation of agricultural products cold-chain through the mobile terminal, improving the efficiency of logistics.

Keywords: cold-chain logistics, agricultural products, mobile terminal.

1 Introduction

With the rapid development of agricultural economy in our country, the demand for agricultural products and the volume is also growing rapidly. Agricultural products themselves have some characteristics, such as saving cycle short, perishable, low temperature storage and so on, therefore, they need to be effective oversight and management in the production, storage, and transportation[1]. Each link in any tiny mistake could cause huge losses, and even lead to food safety hidden trouble. Improvement of information level makes the cold-chain logistics have a comprehensive development, the use of relevant technology such as RFID and WSN make traditional cold-chain logistics monitoring mode cannot adapt to the agricultural information level, therefore, cold-chain logistics monitoring need to meet the current and the development of information technology and user needs[2].

In this paper, by introducing the agricultural cold chain logistics present situation, the three major functional modules and practical case analysis, can effectively improve the current application limitation of cold-chain logistics and logistics efficiency, it can improve the current deficiencies and defects existing in the cold chain logistics of agricultural products, has a certain application value.

2 Agricultural Products Cold-Chain Logistics Present Situation

Agricultural products cold-chain logistics is refers to the perishable agricultural products production, processing, transportation, distribution of behavior such as a series of logistics activities, the whole process of agricultural products needs to be in a state of low temperature[3]. As the attention of the customers to the agricultural product quality and food safety, and security of preservation of agricultural products gradually becomes a necessary. The main flow of Cold-chain logistics chart as shown in the Fig.1.

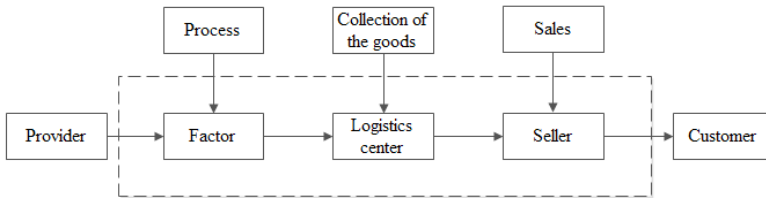


Fig. 1. The Main Flow of Cold-Chain Logistics Chart

In foreign countries, cold chain logistics develop more mature. Mostly adopted in the process of cold collection transportation automatic temperature control device, can real-time monitor the temperature of the cold box changes and ensure that transport goods qualitative change will not occur. Cold chain facilities and cold-chain equipment relatively backward in our country, the original old equipment, development and distribution is not balanced, is unable to provide a low temperature for perishable food circulation system, as for the lagged far behind in the cold chain technology application abroad.

In terms of logistics information system, service network and logistics information system of cold chain logistics in our country plays an important role in the development, service network and imperfect, incomplete information system, the influence on the quality of agricultural products logistics, accuracy and timeliness, at the same time, the cost of agricultural products cold chain and the degree of loss of goods is also high.

Through the research on China's cold-chain logistics development present situation, mainly exist the following problems:

- Cold-chain logistics information utility ratio is low.
- Data is not timely and effective feedback.
- Transportation of agricultural products quality safety exist in the process of great hidden trouble.
- Between each node of supply chain information flow is not smooth

Can be seen from the above problem, the current agricultural products cold-chain logistics information utilization rate is very low, as a direct result of the entire agricultural product logistics process and the information chain of security monitoring is blocked[4]. Meanwhile, Agricultural product logistics in our country has a long time, low efficiency, high cost, poor security monitoring, it is difficult to meet the needs of the market.

Therefore, this paper in view of the present agricultural products logistics existing problem, combining with the consumer in the process of transportation of agricultural products such as real-time monitoring and mobile service requirements, to build a mobile agricultural products cold-chain logistics service system.

3 Cold-Chain Logistics of Mobile Service System Overall Design

Mobile service on patterns of supply of agricultural products, logistics mainly includes three phases: the phase is perishable agricultural products from the production processing vendor to the distribution center of agricultural products, The second stage is the transportation of agricultural products, The third stage is agricultural products delivered to the user, by user sign for it.

In this paper, based on Internet of things and web service technology, the production and processing of agricultural products as a node, with the help of third party logistics complete cold-chain logistics mobile service system. The system structure as shown in the Fig.2.

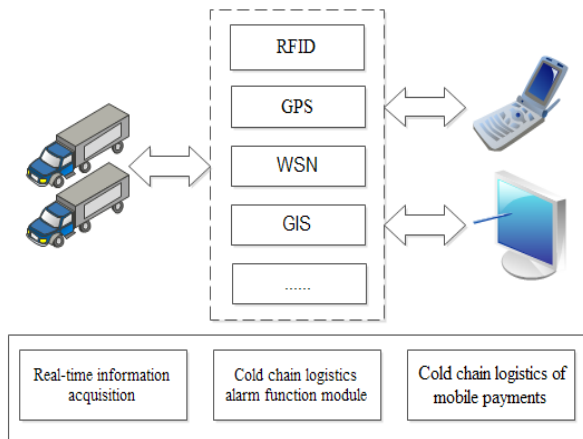


Fig. 2. The System Structure Chart

Cold-chain logistics of mobile services for consumers and the driver provides a convenient and quick service[5]. Complete database system based on agricultural products. Build the real-time data acquisition, cold-chain logistics alarm function module and mobile payment three parts content.

3.1 Real-Time Information Acquisition of Agricultural Products

Agricultural products real-time information acquisition through the electronic label record raw agricultural products production and processing all information, provide

information of origin traceability data base. Using RFID technology, store the key to influence the quality and safety of agricultural products processing information. Information of housing environment was collected through wireless sensor. Through the above information can provide mobile services data base.

Consumers through the electronic label can be directly traced back to the information in the process of production and processing of agricultural products, ensure food safety. System data flow diagram is shown in Fig.3.

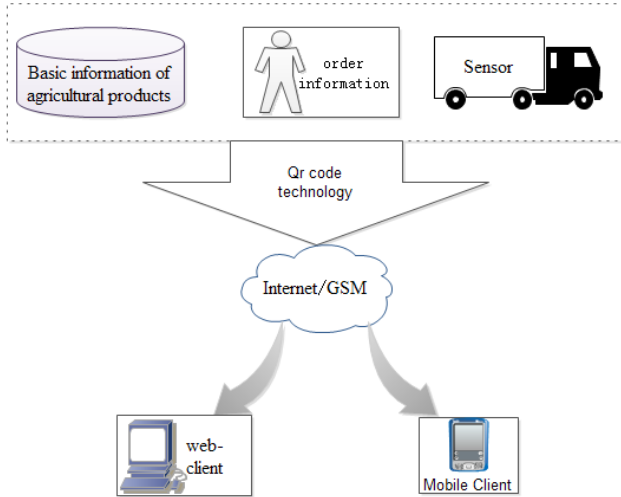


Fig. 3. System data flow

3.2 Cold-Chain Logistics Alarm Function Module

Wireless sensors in the box body can accurately obtain the current situation of the agricultural products logistics vehicle driving on the way, such as body temperature, humidity etc.. Combining different agricultural products quality safety evaluation model, When monitoring data in the box body reaches or exceeds safety threshold, intelligent alarm service will be provided to the truck driver.

The system is based on Web Services Technology, and establishes a shared information system architecture based on Internet. This technology allows users to call web service of the complex agricultural information platform without restraint under the environment of TCP/IP, in order to realize the information share in Internet. Warning module flow chart is as follows Fig.4.

According to the shipping order number, the function obtains the real-time temperature monitoring of the current WSN, and gets the threshold temperature of the agricultural products from Web Service. Every 5 seconds the temperature is compared with the temperature threshold. if it is more than the threshold temperature, rings or SMS alerts are sent to transport driver through the mobile terminal, to timely adjust the environment, and ensure the quality and freshness of the transport agricultural products[6]. Mobile warning mainly has the following advantages: the user does not

need to carry too much hardware device box alarm to save cost; through the use of mobile devices, real-time data of agricultural products can be monitored effectively, greatly improving the utilization rate of agricultural product data[7][8].

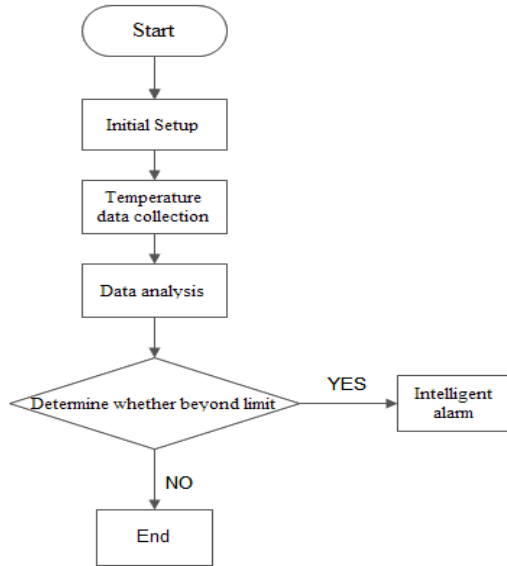


Fig. 4. Warning module flow chart

4 Cold-Chain Logistics of Mobile Payments

Cold-chain logistics mobile service applications provide complete information interaction mode, from sales to transport for the user to provide a convenient and efficient service. The rise of mobile electronic commerce brings development prospects for application in agriculture[9].

Cold-chain logistics mobile payment uses two-dimensional code technology[10]. When the goods are delivered to the users, users can realize online payment by scanning two-dimensional code, and transfer the payment information to the server, implementing the interaction with the server. Ultimately, the users and vendors are identified to ensure the normal sales of goods. At the same time, the entire transport chain is presented transparent to users, ensuring that food safety, sales, transportation can be traced back.

Through the above three modules, the user can use the mobile terminal real-time monitor product transport of live, at the same time, the vehicle positioning, to check the vehicle information in time, convenient for users to manage the goods. Mobile agricultural cold chain logistics services to improve the efficiency of logistics, has solved the traditional user must be in the specified environment view logistics vehicles, have certain application value.

5 Case Analysis

Cold-chain logistics mobile system can provide complete backtracking on meat from farm to consumers throughout the supply chain.

The RFID radio frequency identification and electronic label technology are combined as the solution, which integrates the beef growth with complete processing data in electronic tag. The mobile terminal can use mobile network to access the database, which is convenient for user's inquiries.

Fresh meat are processed by cold-chain logistics monitoring system to ensure its quality and freshness. Meanwhile, the quality of the environment is strictly controlled in the transportation process, once beyond the safety threshold, issue a warning to the driver(Fig.5).



Fig. 5. Casing monitoring view

On the other hand, remote monitoring can monitoring logistics vehicle current location in real time in the electronic map , transportation routes, local condition and so on to provide navigation guidance for transport drivers. Production of beef are transported to vendors and users(Fig.6).



Fig. 6. Vehicle service view

Providing the mobile terminal distribution services can realize mobile sign, mobile place an order, mobile source query and other functions.

6 Conclusions

This paper analyzed the current cold-chain logistics problems and users' need for cold-chain logistics, proposing the key technology and the design of cold-chain logistics service system. Through the cold-chain logistics service system, agricultural products from field to table can be fully in management while the navigation path is provided for Logistics. This system not only ensures the quality and safety of agricultural products, but also saves the cost of logistics, improves the logistics efficiency, and has a broad application prospect.

Acknowledgment. This research was supported by National Science and Technology Support Project of China. (Grant No.2013BAD15B05) and the National Science Foundation Scientists of China(Grant No. 2012BAH20B02), all support is gratefully acknowledged.

References

1. Zhu, C.C.: Study on Farm Products Cold-chain Logistics System of China. Journal of Anhui Agri. Sci. 39(4), 2317–2318 (2011)
2. Wang, Y., Gu, Y.N.: The Study of Agricultural Products Cold Chain Logistics. Logstlcs Engineering and Management 32(9), 4–5 (2010)

3. Liu, G.M., Sun, X.D.: Monitoring and Tracking System Agricultural Products Cold Chain Logistics Based on WSN and RFID. *Journal of Agricultural Mechanization Research* 4(4), 179–182 (2011)
4. Qi, L., Han, Y.B., Zhang, X.S., et al.: Real Time Monitoring System for Aquatic Cold-chain Logistics Based on WSN. *Transactions of the Chinese Society for Agricultural Machinery* 43(8), 134–140 (2012)
5. Zhou, X.M., Qian, J.P., Yang, X.T., et al.: Review the Application of Information Technology in Agricultural Products Logistics and Distribution. *Chinese Agricultural Science Bulletin* 26(8), 323–327 (2010)
6. Yang, X.T., Qian, J.P., Fan, B.L., et al.: Establishment of Intelligent Distribution System Applying in Logistics Process Traceability for Agricultural Product. *Transactions of the Chinese Society for Agricultural Machinery* 42(5), 125–130 (2011)
7. Wang, H.J.: Research on Cold Chain Temperature Monitoring System Based on Wireless Sensor Network, pp. 1–45. Harbin University of Science and Technology, Harbin (2011)
8. Alessio, C., Simone, C., Marco, P., et al.: A Wireless Sensor Network for Cold-Chain Monitoring. *IEEE Transactions on Instrumentation and Measurement* 58(5), 1405–1411 (2009)
9. Zhang, L., Pang, Y.: Comparative Study on Mode of Agricultural Products Cold Chain Logistics. *Logistics Engineering and Management* 32(10), 1–6 (2010)
10. Fu, X.X., Zhou, S.Q., Xie, X.P.: Smart Monitoring and Tracking Technology for Transportation Equipment of Agricultural Products Logistics. *Journal of Agricultural Mechanization Research* 8(8), 166–169 (2010)