Application of Internet of Things Technology in Logistics Distribution of Perishable Agricultural Products

Wujun Cao, Xinxin Wang*, Hanxing Hao
Institute of Management Engineering, Zhengzhou University, No. 100, Science Avenue, Zhengzhou, China
xina993@163.com

Keywords: Internet of Things, Perishable agricultural products, Distribution, Information exchange

Abstract: The use of Internet of Things technology and perishable agricultural products, logistics and distribution combined helps cope with the perishable agricultural products in the distribution of low degree of information, low efficiency and other issues. This paper, based on the shortcomings of traditional perishable agricultural products logistics distribution, discusses from the network layer, the perception layer, the application layer respectively based on the Internet of things perishable agricultural products logistics and distribution technology system construction. The Internet of things in the perishable agricultural products distribution application will help better promote the development of perishable agricultural products distribution system, which is conducive to speeding up the development of China's modern perishable agricultural products logistics.

1. INTRODUCTION

At present, the development of distribution is still in the stage of traditional logistics and distribution, there are high energy consumption, low efficiency and high cost. Distribution is an important part of logistics activities, logistics activities play an important role, only through distribution, logistics activities can eventually be achieved. Perishable agricultural products logistics is a more special field in the logistics industry, with a wide range of sources, large quantity, perishable, timeliness and other characteristics, while perishable agricultural products distribution radius is small, more logistics center, road conditions are more complex, lot more, more varieties. According to the "Information and Communication Industry Development Planning Network of Things (2016-2020)" released at the beginning of 2016, it provides guidance for the development of China's Internet industry in the next five years. Since 2016, China's Internet of Things and cloud computing, large data, artificial intelligence, 5G, low-power wide-area communication network and other new technologies to accelerate integration, showing integrated innovation, iteration upgrade and other new features. Internet of Things is based on the computer internet, the use of RFID, wireless data communications and other technologies to make objects and the internet interconnection between the items do not rely on human intervention, to each other to "exchange" to achieve automation, information and the purpose of networking. The use of Internet of Things technology to promote the construction of perishable agricultural logistics information, to strengthen the agricultural logistics and distribution tracking, monitoring, transport routes and related decision-making to provide data support, to solve the traditional perishable agricultural products in the distribution of low efficiency, time-consuming, high loss and other issues of great significance.

1.1 Perishable Agricultural Products Distribution

Agricultural product logistics and distribution is in the specific economic area, through the sorting, processing, quality inspection, packaging, storage, transportation and other operational processes, the agricultural products eventually sent to the hands of consumers in the process. Agricultural product logistics and distribution system construction is to solve the agricultural products "difficult to sell", "difficult to buy" an effective way. (Mei Chen, 2017) Perishable agricultural products is short shelf life, easily perishable fruits and vegetables, meat, fresh water products. In recent years, people demand for perishable agricultural products is also gradually increased, the quality of perishable agricultural products also put forward higher requirements. But perishable agricultural products in the process of the loss of great losses, the quality is also difficult to guarantee. And perishable rotten rotten agricultural products are mostly due to delivery technology is not up to standard delivery time is poor, sorting packaging process failure and other reasons. The study found that perishable agricultural products distribution system is not complete, inspection and quarantine failed, sorting and circulation processing is not compliance and other issues still exist, perishable agricultural products in the distribution of this part of the loss rate accounted for almost 50% of the total loss.

1.2 Internet of Things

In 1999, Professor Ash-ton of the Massachusetts Institute of Technology's AUTO-ID Center presented the concept of Internet of Things for the first time. Internet of Things uses radio frequency identification technology (Radio Frequency Identification, RFID), wireless communication technology, based on the computer Internet, based on the construction of a cover the world all things covered the physical Internet.(Yun Chen, 2010) At present, the academia is more recognized by the Internet of Things is defined as: through radio frequency identification (RFID), infrared sensors, GPS, laser

scanner and other information sensing equipment, according to the agreement to connect any items connected with the Internet , Information exchange and communication, in order to achieve intelligent identification, positioning, tracking, monitoring and management of a network. (Dongmei Huang, 2011) So a thing can be broken down into the logo, perception, processing and information transmission four links, each link of the key technologies are radio frequency identification two-dimensional code, sensors, smart chips and telecom operators wireless transmission network.

1.3 Related Research Status

In CNKI, we use the "Internet of Things + distribution" as a key word for the retrieval of core journals and found that by 2017 has more than 600 papers, indicating that the Internet of Things in the distribution of the application has been more mature; Down to "Internet of Things + agricultural products distribution" as a key word for the retrieval of core journals and found that only 2017 articles in 2017, indicating that the Internet of things in the distribution of agricultural products in the application of research less; then, "Internet of Things + Perishable agricultural products distribution "and" Internet of Things + perishable agricultural products + distribution "as a keyword to search, did not find the relevant literature, that the Internet of Things technology in perishable agricultural products in the application of research is still vacant. Therefore, taking into account the importance of related research, this paper identified the Internet of Things technology in the perishable agricultural products in the logistics and distribution of the situation.

According to the investigation, it is found that the reasons for the serious loss in the process of destroying the perishable agricultural products can be divided into three categories: one is in the distribution and circulation, and the supervision is not enough to cause the fake and shoddy agricultural products to be mixed in the market. , Resulting in low delivery efficiency, perishable agricultural products in the distribution process of the loss of serious; Third, poor information management led to perishable agricultural products can not trace the source, affecting the consumer's perishable agricultural products trust. Therefore, this article introduces the concept of Internet of things, focusing on things from the Internet to solve the problem in the distribution of perishable agricultural products.

2. PRESENT SITUATION

For perishable agricultural enterprises, efficient logistics and distribution model is the key to providing quality products, reducing overall costs and improving service quality. However, the development of the perishable agricultural products logistics is still relatively backward. Even with the efficient logistics and distribution mode, there are still many problems in the logistics and distribution of perishable agricultural products. The distribution situation is not optimistic.

2.1 Low Degree of Information

In China, the development of perishable agricultural products logistics is relatively late, the logistics and distribution of all aspects of information technology construction is relatively backward, the information network is not perfect, resulting in the information between the various links can not be achieved in a timely manner, resulting in serious market information asymmetry: for perishable agricultural products the production of the main body, due to the timely perception of market demand changes, changes in the natural environment and other suppliers of production inputs, resulting in "bullwhip effect" to enlarge the demand for perishable agricultural products, and eventually led to excess market supply , perishable agricultural products devaluation, but also exacerbated the waste of agricultural products, increased delivery pressure; for perishable agricultural products wholesale market, due to the distribution of information opaque, lagging and lack of coordination mechanism, often make perishable agricultural products squeeze or cause shortages Such as the use of information asymmetry, capital leverage disrupt the market, while lowering the purchase price of agricultural products, while raising the sales price of agricultural products, and thus the formation of the rich and so on, so that the market is due to oversupply and overpaid or in short supply and " intermediate benefits, in addition, the lack of information exchange platform, but also the lack of coordination between the various sectors, resulting in incompatible supply and demand, poor distribution.

2.2 Lack of Traceability

Driven by the interests, but also to reduce the cost of perishable agricultural products to extend the preservation of perishable agricultural products, so that perishable agricultural products "sell phase" better, better taste, thereby increasing the price of perishable agricultural products, some manufacturers, sales businesses often add a variety of pigments, hormones or toxic drugs to perishable agricultural products. On the other hand, the imperfect detection facilities, the backwardness of detection methods, and the lack of retrospective query systems make it impossible to diversify the market query the distribution terminal, tracking the circulation process, tracing the origin of perishable agricultural products, which is more rampant of this behavior, leading to perishable agricultural products there are serious quality and safety risks. The use of antibiotics, toxic additives, pesticides exceeded, etc., has been a serious threat to our lives. At present, China has promulgated the "People's Republic of China Agricultural Product Quality and Safety Law" and other relevant laws, but to be very good implementation is not easy, the use of related technology and equipment is very important.

2.3 Lack of Detection

Perishable agricultural products with a large number of species, wide source, perishable, timeliness, difficult to store and so on. However, the current logistics industry, the vast majority of enterprise logistics and

technical equipment level is very low, specialized agricultural transport vehicles rarely: such as logistics and distribution vehicles, convertible trucks accounted for about 70%, only 30% of the sealed car , Which has refrigeration machinery, insulation box refrigerated vehicles less than 10%, so most of the transport of perishable agricultural products can only use the normal temperature logistics or natural logistics form. Technical equipment, backward, the lack of means of monitoring, so that the temperature, humidity and other storage environment, real-time monitoring and intelligent adjustment can not be fully realized, resulting in most perishable agricultural products due to tariffs, capacity, traffic conditions and product preservation technology caused by rot, deterioration, and thus huge losses. Relevant data show that China's fruit and vegetable and other perishable agricultural and sideline products in the picking, transportation, storage and other logistics links on the loss rate as high as 25% to 30%, which in the transport of rotting fruits and vegetables every year there are 37,000 tons, Billion people living, while the developed countries, fruit and vegetable loss rate is controlled below 5%.

2.4 Low Delivery Efficiency

China's perishable agricultural products from the production of farmers to the origin of the wholesale market and then to the wholesale market wholesale channels are "long", a large number of brokers, the level of complex, increasing the complexity of the logistics and distribution work environment - the distribution of goods and distribution technology behind, the traffic information, vehicle information and distribution of freight information can not be timely access to the deployment of the distribution site, the distribution of the distribution network, the distribution of goods, the choice of distribution path is also based on the vast majority of distribution experience and habits, so the lack of scientific and rational, resulting in distribution path is not excellent, logistics links see the convergence of poor, so that the possibility of logistics and distribution delays, efficiency. On the other hand, the process of crossing the crossing inspection, high-speed intersection fees will also increase the perishable agricultural products distribution delays, extend delivery time, reduce distribution efficiency and increase delivery costs. Perishable agricultural products logistics and distribution of this situation, with the consumer of agricultural products personalized, fresh, diversified and harmless demand services to improve the performance is particularly prominent.

3. INFORMATION EXCHANGE OF DISTRIBUTION

The construction of the perishable agricultural product distribution network mainly includes two aspects of information exchange, information exchange between the distribution link and other links, and the information exchange of the distribution link itself.

3.1 Distribution and Other Aspects of the Exchange of Information

In the circulation of perishable agricultural products, the distribution link is generally connected upstream and perishable agricultural products processing enterprises and perishable agricultural production base, connecting the downstream and sales terminal of the link, the Internet of things distribution management is based on this design. Through the Internet of information platform, before and after the exchange of data between the exchange of almost does not take up valuable time, while government departments and consumers can also be very convenient to monitor and query(Junde Han, Qiguang Du, 2015). Shown in Figure 1:

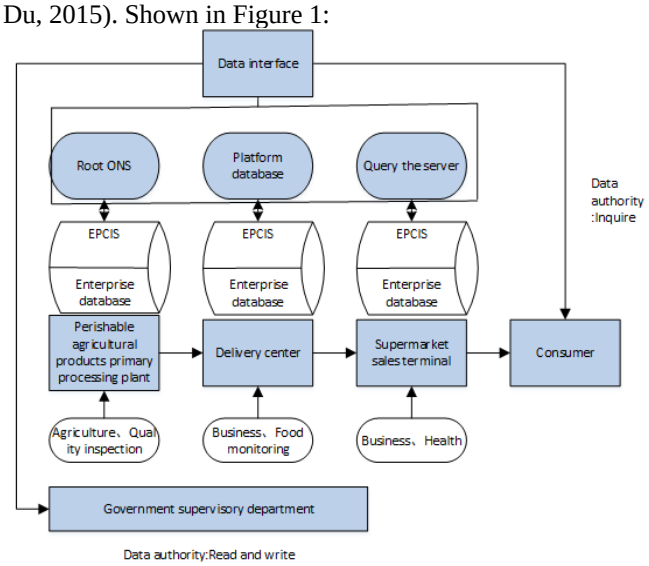

Figure 1: Coordination and Interaction of Information System between Perishable Agricultural Products Logistics System Based on Internet of Things

3.2 Information Exchange within the Distribution Link

In addition to the distribution of perishable agricultural products in addition to the need for distribution centers and upstream perishable agricultural products processing links, downstream perishable agricultural products sales links for information sharing and synchronization management, the distribution center storage, sorting, packaging, inventory, inventory, etc. Links of the operation also need to share information, only for each link information to do a good job, and published in the Internet of Things information platform, in order to more quickly exchange information for rapid distribution and quality traceability. (Xiangyou Ma,et al, 2012)Shown in Figure 2:

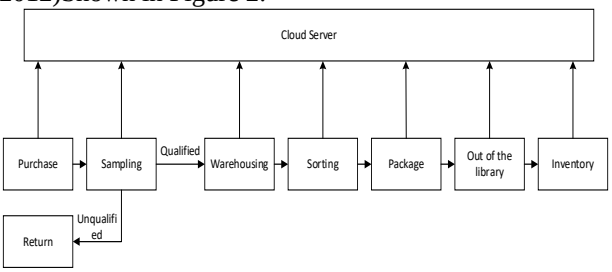

Figure 2 Distribution of Information between the Internal Information Platform

4. PERISHABLE AGRICULTURAL PRODUCTS DISTRIBUTION NETWORK TECHNOLOGY SYSTEM

Perishable agricultural products distribution system, including the entire distribution process of the whole process of tracking management, involving procurement, sampling, storage, sorting, packaging, a library, inventory of all links. Distribution platform related to the application of services for the distribution of links, the information collected in a timely manner to the Internet of Things platform, and ultimately in the distribution platform for the whole process of presentation, to achieve real-time monitoring, including distribution process can be monitored, distribution quality can be regulated, The distribution line can be optimized and the delivery information is available.

4.1 Perishable Agricultural Products Distribution Network

The collection of data in the perishable agricultural product distribution model based on the Internet of Things is mainly through the collection of the key logistics information of the fixed distribution point and the fixed distribution vehicle to reflect the state of the perishable agricultural products in the distribution stage. But also to collect the data collection point of mobile information, such as refrigerated trucks, refrigerated car temperature and sign information. (Jia Feng, 2017) In the layout of the wired network to facilitate the selection of cable network for information transmission, in the area where the cable network is not easy to arrange, the vehicle to take the wireless network to instantly transmit information. Transmission and communication is the core of the perishable agricultural products distribution network, with Bluetooth, WiFi wireless networking, broadband transmission, 3G / 4G mobile wireless network transmission mode. In the perishable agricultural products circulation, vehicle deployment, path selection link using Internet communication and GPS technology combined way to provide the analysis of goods, stowage calculation, and the choice of transport routes. The system supports global positioning (GPS) and geographic graphics system (GIS), to achieve the best route selection and dynamic deployment. To achieve the best vehicle carrier transport, improve the efficiency of transport vehicle resources and operational efficiency of the business, reduce transportation costs, to achieve the transport of goods in transit management. (Yuee Zhou, 2017)

4.2 Perishable Agricultural Products Distribution Network Awareness Layer

Sensing sensor as the core application of the perceptible layer of perishable agricultural products distribution, mainly to realize the sensing terminal of information detection, recognition, positioning and tracking, and carry the application signal that transforms the pericable agricultural products into the processing signal. The sensing layer involves the key technologies such as sensor technology, RFID technology and two-dimensional code technology, and formed various core devices such as sensor, RFID device, bar code equipment, camera equipment and positioning equipment, and can carry out the whole process of perishable agricultural products distribution. Information perception. (Jianwei Wu,et al, 2017)

4.3 Perishable Agricultural Products Distribution Network Application Layer

Analysis and processing of perishable agricultural products distribution network application layer of the core application, for the terminal stores and end consumers, the main role is to integrate and analyze the data to achieve perishable agricultural products distribution of the whole process of service applications to achieve the distribution process Visualization. Terminal stores and consumers can access the information on the temperature, humidity, perishable agricultural products and the safety of products in the distribution process, Basis.

- Through the Internet of things, the use of bar code scanning technology, RFID technology, for perishable.
- Based on the Internet of things technology to promote and strengthen the perishable agricultural products logistics and distribution of information technology for farmer production and consumer consumption to provide scientific information; Agricultural products affixed with electronic tags, and write on behalf of the identity of the agricultural identity of the unique ID code and a variety of norms and interoperability of information through wireless data communication network technology, they automatically collected to the central information system, the formation of agricultural product quality and safety ".
- The use of wireless sensor network technology to detect the perception of unknown objects and their parameters of information, real-time access to agricultural products logistics and distribution process temperature and humidity and other environmental parameters, to achieve the distribution of the distribution of the ".
- Through the GIS's strong geographical data function, to obtain the distribution of the necessary conditions to ensure that the transport and distribution environment to meet the needs of the perishable agricultural products on the preservation of quality and reduce the loss of agricultural products in transit; Geographical environment information, design scientific and rational distribution routes, sections About the cost and delivery time; the use of car GPS for their own positioning, timely access to road and vehicle information to improve distribution efficiency, saving loss in transit.

5. CONCLUSIONS

Internet of things is the development of logistics industry needs, the application of Internet of Things technology in logistics and distribution will greatly promote the level of logistics information, improve the efficiency of logistics and distribution, to achieve the visualization of distribution, for the change of China's perishable agricultural products logistics distribution is relatively backward And accelerate the development of

modern logistics in China has an important role. In the perishable agricultural products logistics distribution, through the application of Internet of things technology can improve the perishable agricultural products in the process of logistics and distribution problems. Of course, limited to the level of development of Internet of Things technology, Internet of Things technology in the distribution of agricultural products in the application of the risk assessment has yet to be done to strengthen risk management.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the support of institute of management enginering, the other author's support.

REFERENCES

[1] Dongmei Huang, 2011. Application of Internet of Things Technology in Disaster Relief Material Distribution Management System, Computer Application Researc. (28), pp. 189-191.
[2] Jia Feng, 2017. Construction of Cold Chain Logistics Model for Urban Fresh Agricultural Products Based on Internet of Things. Internet Technolog. (01), pp.71-74.
[3] Jianwei Wu,et al, 2017. Analysis on the Network System of Agricultural Product Safety Traceability, Modern Agricultural Science and Technology. (5), pp. 282-288.
[4] Junde Han, Qiguang Du, 2015. Application of Internet of Things Technology in Distribution of Fresh Agricultural Products, China Circulation Econom. (12), pp.54-60.
[5] Lulu Liu, 2017. Study on Distribution of Fresh Agricultural Products in O2O Mode, The Business Circulate. (12), pp.10-11.
[6] Mei, Chen, 2017. Research on the Design of Agricultural Products Distribution System from the Perspective of Internet, Introduction to Economic Studie. (8), pp. 45-46.
[7] Xiangyou Ma,et al, 2012. An Analysis of the Status Quo of Research and Application of Internet of Things in Domestic Agriculture, Tianjin Agricultural Sciences. 18(6), pp.69-72.
[8] Yang Xue , 2014. Research on the Application of Internet of Things Technology in Agricultural Products Logistics Informatization, Network Application. (14), pp.43-45.
[9] Yuee Zhou, 2017. Design of Modern Agricultural Intelligent Logistics System Based on Internet of Things Technology, Chinese Journal of Agricultural Mechanization. 35(5), pp.257-260
[10] Yun, Chen, 2010. Thoughts and Suggestions on the Development of Internet of Things Industry in China, Research on Science and Technology Management. (20), pp. 103-105.