Research on IOT Based Special Supply Mode of Agricultural Products

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Abstract—IOT applications in the field of agriculture is an important part of modern agricultural development, it brings agriculture to digital and information era, and it is an important direction of agricultural development in the 21st century. With the advent of the cloud era, big data has attracted more and more attention and is being applied to various fields, while agricultural big data is the inevitable trend of future agricultural development. This article describes application of agricultural big data and establishment of IOT technology system in the field of agriculture, and special supply mode of agricultural products is also introduced. Incorporation of agricultural IOT with sensing technology ,agricultural big data and other technologies is emphasized, which can achieve growth environment management and the whole lifecycle management, all processes include growth, production, processing, distribution and sales process, all of above can provide a feasible way for solving food safety issues. With the global information network development, technology upgrading of agricultural logistics management is imperative.

Keywords-IOT; RFID technology; agricultural big data; modernization, special supply

I. INTRODUCTION

In recent years, agricultural development in China has made great progress. However, with the requirements of agricultural modernization, there are many things to do. One of which is how to fully explore and utilize modern resources and advanced theories of management, so as to achieve modernization of agricultural logistics of China. It is said that ultimate purpose of agricultural logistics is to achieve its value during the sales process, so as to prevent overstock of agricultural products which may lead to value forfeiture. Therefore, distribution logistics is the most important one in all agricultural logistics. Data of CGCC(China General Chamber of Commerce) display that total cost of logistics in China is about 18% of GDP of the year since 2005, the value is still high, while for western countries, the value is only 8-10%, difference of standardization and informationalized level is significant. A news reported a research on industry chain development of IOT at home and abroad.

The research shows that, 2010 is the most important year for development of IOT industry, and market size of IOT industry in China will reach to 180 billion Yuan, in 2015, whole market size of IOT industry in China will reach to 700 billion Yuan, compound annual growth rate will be over 30%. If more companies understand RFID, application of RFID will be increased explosively.

Some international consultative machineries think that, in this year, global usage amount of various kinds of RFID volume labels and labels with different frequency, standard and types is 10 millions, in 2007, the amount can reach to 100 millions, and in 2008, the amount can reach to 20 billions. Reports show that, circulation cost of vegetables in China occupies 50%～70% of the total cost, the cost is too high. Thus a vicious cycle of vegetable cost forms, vegetable growers can not afford to grow vegetables , and residents can not afford to buy vegetables. It is investigated that, from field to market, the price increases to 10 times of the initial cost, that is to say, the price increases by more than 10% in each intermediate link. For this reason, consumers are hard to buy cheap and green organic agricultural products.

II. EXISTING PROBLEMS IN CIRCULATION PROCESS OF AGRICULTURAL PRODUCTS

In recent years, there are many reports about food safety incidents such as 'toxic bean sprout'. These make agricultural products monitored more strictly, in order to make customers enjoyed relieved vegetables, we need supports of technology to ensure safety of foods.

Intermediate links are too long, this lead to a vicious cycle of vegetable cost, vegetable growers can not afford to grow vegetables , and residents can not afford to buy vegetables. I

Currently, most of agricultural products in China are produced by traditional production methods, this lead to big labor cost, the efficiency is too low.

Logistics transportation process of agricultural products is nonstandard, it lacks of real time monitoring and following services .

At present, our country lacks of emergency system for crisis of agricultural products， thus if problems appear in the process of circulation and production, responsible party is hard to find.

Information of agricultural products and customers is disorder, and there is no information carrier for integration of these data.

III. IOT BASED SPECIAL SUPPLY MODE OF AGRICULTURAL PRODUCTS

A. *Safety of vegetables*

In agriculture industry，Foodborne（chemical and biological）harms are main factors for safety of vegetables in China, currently, our country lacks of system monitoring and evaluation data about foodborne harms，thus many pollution situations in vegetables of our country are not understood well. Large-scale plantation and utilization of RFID technology can design a label for each land parcel or each breed. The required information for the whole process（from plantation to packing and marketing）are inputted through read-in and input equipments, information include vegetable varieties, growth time, name and use frequency of pesticides，chemical fertilizers used and harvest time etc, sometimes, information include characteristic description of breeds. According to code standard of agricultural products, a code is defined for each vegetable breed as its unique identification， for a vegetable breed，when the first link of the supply chain is finished，the RFID（or radio frequency card）has already stored all essential information. When an enterprise purchases vegetable breeds at any land parcel，information collection can be performed for peasant households and agricultural products by using data collectors. This can not only accelerate purchase rate, can also reduce error rate, in addition, it can provide essential data of POS system, EDI, e-commerce and other systems for processors of agricultural products. It can also provide original data for product tracing. Safety of foods is ensured firstly by RFID technology.

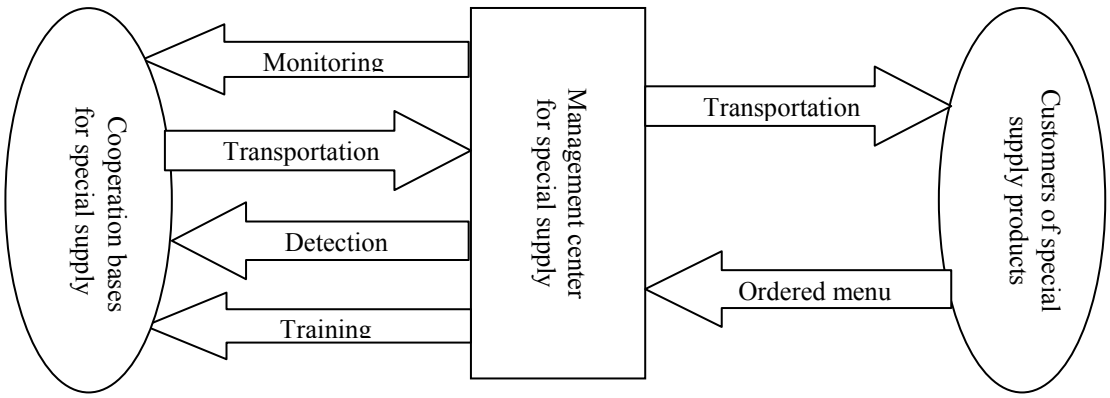

Figure 1. Management center for special supply

B. *Product supervision*

Currently, with the rapid development of industrialization and urbanization in China, portion of agriculture in national economy reduces rapidly, in 2012, added value of agriculture reduces from 30% of GDP(before the reform and opening-up policy) to 10% of GDP. Nonetheless, this doesn't mean that agricultural position is decreased, in contrast, quality requirement of agricultural products has reached an unprecedented height, thus supervision of food safety is more and more important. Usage amount of pesticides should be supervised termly. And pesticides should also be checked if conform to standard of security. This may increase labor cost, however, if IOT technology is used, air humidity, soil moisture , temperature, concentrations of carbon dioxide , illumination intensity ,video image in greenhouses and usage amount of pesticides can be obtained remotely, all of above can provide guidance for production, therefore, establishment of communication terminal and sensing network is very important.

Environmental information of greenhouses is collected at relay nodes by internal self-organizing network, environmental information of greenhouses can be monitored by monitoring centers through communication network among greenhouses and communication network between greenhouses and monitoring center of farms.

Video monitoring system can effectively supplement data information, based on network technique and video signal transmission technique, the system can provide all-weather video surveillance for growth status of crops in greenhouses. The system composes of network video server and camera with high resolution. Network video server mainly provideS transition and transmission of video signal, and it can also realize long-range online video services. Based on the internet, if one can surf the net, long-range image visit can be performed according to user permission, multipoint and online convenient monitoring can be realized. Production sources should be controlled strictly, so as to ensure that customers can buy fresh and green vegetables.

C. *Transportation of agricultural products*

Application in transportation of agricultural products is mainly presented as monitoring，tracing and crossing check of in-transit agricultural products. RFID can provide real time monitoring and follow-up service for logistics companies. Through data collection center big data，customers can search position of their goods easily by computer networks. Meanwhile，metamorphism time and reason of agricultural products can be recorded in transit, thus can determine which link goes wrong.

D. Emergency plans for crisis of agricultural products

Agricultural industry is a typical process manufacturing industry，its characteristic is that products are irreversible，safety management system of products in special supply mode is mainly divided into 3 links，which include production， transportation and sales process. Food safety problems may occur in each link. Once a critical situation occurs， logistics companies and consumers can not only find final consumer of each food on the basis of safety tracking system of agricultural products. They can also find problematic link in the circulation and production process, thus forms a link chain which is managed and operated effectively. Food quality should be ensured.

E. Cost problems

Vegetables should be distributed according to the menu everyday, so as to ensure that the vegetables are fresh and cheap. Many intermediate links are omitted, this can not only provide green vegetables with high cost, also can ensure that vegetable growers and consumer all get benefit, so the ultimate aim of Win-win can be realized. Vegetable growers can seed according to the menu, special supply transport companies can place an order to vegetable growers. Big data statistics system is used, special supply transport companies will tell vegetable growers which kind of vegetable should be grown in special period, according to market order, special supply companies guide vegetable growers to grow which kind of vegetable, and they provide seeds, technical guidance, agricultural capital, purchase and distribution uniformly. Therefore, production enthusiasm of peasants is protected, and vegetable cultivation industry is further stabilized. Meanwhile ,we may doubt that if consumers and peasant households all benefit from that, do special supply transport companies benefit from that? Special supply businesses mainly benefit from big sales volume, this can solve sales volume problems when plenty of vegetables come into the market, special supply transport companies find their own profit model, so tripartite benefit is realized.

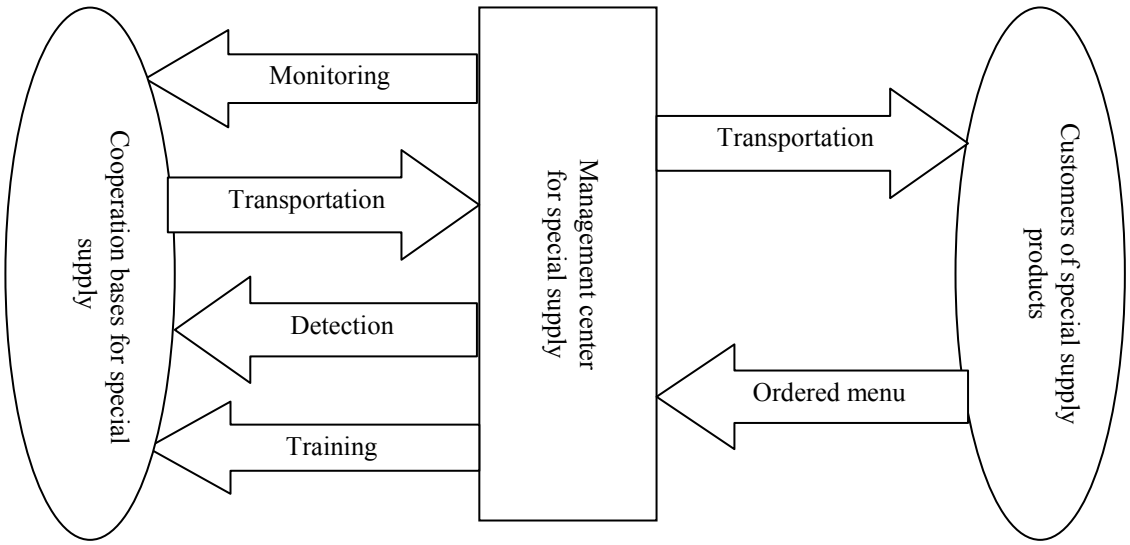

Figure 2. Management center for special supply

F. Service problems

Integration of customer resources is a modern logistics activity which collects customer resources into big data by information system and IT technology for unified design and application. our services aim at peasants and special supply consumers. Firstly, our services aim at special supply consumers, we provide different products and services according to the customer value, so as to improve satisfaction of customers, and we often transform pleased customers to VIP customers, then we establish strategic partnership with these customers for long term cooperation, and we often provide preferential policy for these customers. Therefore, the target of minimization of cost for customer service, maximization of efficiency and benefits of customer services can be realized finally. Logistics enterprises should continuously integrate customer resources according to idea of system optimization and supply chain management, thus can forms large-scale, intergrated and personalized customer services. Secondly, our services aim at vegetable growers, we also collect peasant information in a system by information system and IT technology, all peasants are divided into different classes according to their creditworthiness and satisfaction degree of special supply consumers.This can significantly increase positivity of peasantS for providing superior vegetables, thus our services will be more perfect.

IV. EXISTING PROBLEMS AND SOLUTIONS

R&D ability of core technologies in China is low, especially in the field of chip IC. As for RFID technology and wireless sensor network technology which used to support IOT, current status is as follows: almost 100% of RFIC and MEMS sensor IC used for wireless sensor networks in China are foreign products, except for HF frequency band used for short range recognition, label IC of UHF frequency band and reader IC used for long range

recognition are foreign products. Although congeneric IC exists in China, its technical index and stability is far from world standard. In future, just like promotion of 3G and Loongson, our country should develop superior homebred core chip ICs, this can promote development of IOT, we should also industriously promote research and development of IC by scientific research institution of in universities, and we can organize integrated circuit enterprises to realize industrialization of Chip IC related to IOT.

Lack of standardization system. The biggest bottleneck restricting the development of IOT industry is lack of standards. Based on the industry technology, it mainly lacks of two standards: standardization of data model and standardization of interfaces. We can discuss with IOT departments of various countries and establish a global standardization system jointly.

UHF cost bottleneck can restrict market development. According to the analysis, the cost of current domestic barcode is generally below RMB 2 cents, and even if large-scale production is realized, current cost of RFID tags can only be controlled at 5 cents or so. Many problems exist in the application process of IOT in agricultural industry, which include complex terrain and natural environment, high cost of sensors and related equipments. Generally, price of agricultural products is low, cost of equipments and devices is high, this makes equipments including electronic label applied to a single product, this significantly hinders its widespread application in the agricultural production. We can consider such a problem, in the same RFID technology application system, if the electronic tags are used in the more links, the more fully the reader be used, the more the cost be decomposed, diluted and agreed.

Traditional planting scale is too small, it cannot reach the scale level for supporting agricultural IOT. Planting scale of our traditional rural household contract management mode is too small. At present, total number of peasant households is 250 million, per capita cultivated land is less than 1.4 mu, per household cultivated land is less than 6 mu, this situation has seriously restricted investment capacity of peasant households. According to estimates, average price of a set of complete agricultural network terminal facility is 100,000 yuan, average annual operation and maintenance cost is about 10,000 yuan, obviously, traditional growers can not afford the cost. At the same time, small-scale farmers have greater self-sufficiency nature, market risk is small, they lack of power to reduce operating risk by using Internet technology. In the face of this problem, we should firstly start from farmers, promote and popularize rural IOT, furthermore, we should motivate enterprises to invest in rural IOT and develop marketization mechanism.

V. CONCLUSION

IOT is a new stage of global informationization development. Rapid development of IOT technology provides unprecedented opportunities for agricultural informatization and industrialization. Recently, IOT based special supply mode of agricultural products in China are now in research stage, the technology has not been used in practical application of agricultural production. Look forward to the future, the state and the government have already pointed out an imposing strategic target of IOT development ‘eading China’, meanwhile, it indicates direction for establishing agricultural IOT ‘Reading agriculture ’ . Development of new business model of IOT based special supply agriculture can promote and improve development of modern agriculture.

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