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Research on Agricultural Intelligent Information Platform Based on Internet of Things and Cloud Computing Services

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ABSTRACT

Due to the low degree of integration of informatization related technologies, the immature software design and the lack of standardization of agricultural information, agricultural development in China is seriously insufficient in the use of Internet of things technology, which restricts the development of agricultural production management. By building an agricultural intelligent information platform based on the Internet of Things and cloud computing technology, collecting agricultural data for data analysis, realizing data storage, management control and cloud data analysis functions, it can effectively promote the development of intelligent agriculture.

Keywords: *Internet of Things, gateway matrix arrangement technology, Cloud computing services, Intelligent agricultural information platform Component.*

1. INTRODUCTION

The combination of cloud computing and the Internet of Things has three types of information platforms: single-center-multi-terminal, multi-centric-large number of terminals and information, and application stratification-massive terminals[1].The single-center-multi-terminal model is applied to a smaller area, such as traffic monitoring at a high-speed road section.The data and information obtained by the Internet of Things terminal are uniformly stored and processed by the cloud center and provided to the user with a unified operation or viewing interface. Multi-center-large number of terminal models are suitable for enterprises and units with large regional span, such as the production process monitoring and product quality tracking of each branch of a multinational group. Information, application of layered treatment-massive terminal mode for users wide range, information and data types, security requirements of higher features can be built according to the requirements of the reasonable distribution of resources[2]. and conquer each component separately. The compositional verification techniques include assume-guarantee reasoning [9], contract-based methods [10] and invariant-based methods [11]. This paper focuses on assume-guarantee reasoning, which is an automatic method of compositional verification. To account for the relationship between the whole system and its different components, assume-guarantee reasoning gives some rules, which can change the global verification of a system into local verification of individual components.

Theoretically speaking, applying the assume-guarantee reasoning into stochastic model checking is a feasible way to solve the state explosion problem. There is some research work done in this direction [12–15]. We argue that applying the assume-guarantee reasoning into stochastic model checking should solve the following four issues, which is named as AG-SMC problem: (1) How to generate appropriate assumptions. (2) How to check the assume-guarantee triple. (3) How to construct a counterexample. (4) How to verify a stochastic system composed of n ($n \geq 2$) components.

2. INTERNET OF THINGS TECHNOLOGY AND AGRICULTURAL DEVELOPMENT

2.1 Agricultural demand for Internet of Things technologies in our country

In order to further improve the agricultural construction in our country, we must transform from traditional agriculture to modern agriculture, establish intelligent agricultural information platform by using the Internet of things technology, and change the traditional agricultural development way. The research of agricultural informatization includes many aspects, the most important of which is the theory and technical practice of intelligent agriculture, precision agriculture, and agricultural object network. This is the main research direction of many workers engaged in the construction of agricultural informatization platforms. In the application of information technology in agriculture, developed countries

in Europe and the United States have already realized the agricultural production, resource utilization, and circulation of agricultural products in the Internet of Things[3]. These good experiences have provided an important reference basis for the development of agricultural Internet of Things technology in China and used them as a reference. Through the development and innovation of China's technology will form a group of good industrialization application model, thus promoting the development of related emerging industries.

2.2 Problems in the development of the agricultural goods network in our country

Domestic agricultural Internet of Things software cannot keep up with the development of hardware, many domestic agricultural Internet of Things software cannot achieve its expected results. But importing software systems from abroad is expensive, and these high costs make many agricultural operators helpless. They often cannot afford the hardware but cannot afford the software, which needs to solve the software design problem of the agricultural Internet of Things.
Agricultural data obtained using the Internet of Things technology must be a large amount of data, and the processing of such data must be combined with cloud computing technology. At the same time, in order to facilitate the collection and processing of agricultural data, it is necessary to establish standards for agricultural information.

3. RESEARCH ON AGRICULTURAL PROPERTIES NETWORK ARCHITECTURE

The research on the architecture of agricultural Internet of Things began with the Internet of Things research development report submitted by the European Intelligent System Integration Technology Platform in 2009. In this report, the Internet of Things is divided into many types and directions. Among them, the Internet of Things in Agriculture and Aquaculture is one of the most important directions for future development.Although the Internet of Things has undergone several years of development, as a new type of technology application, many aspects have not yet been perfected, especially in agriculture, and a standard, open, and extensible architecture of the Internet of Things has not been established. However, in the report, the architecture of the Agricultural Physics Network was roughly divided into three levels: the information perception layer, the information transmission layer, and the information application layer.

4. DESIGN OF THE NETWORK OF AGRICULTURAL THINGS SYSTEM

4.1Wireless Internet of Things Gateway and Matrix Distribution Technology

In the agricultural Internet of things system, the perceptual layer and the transmission layer are at the bottom of the system, which guarantees the normal operation of the entire Internet of Things and is the foundation of the Internet of Things system. This paper proposes the wireless Internet of Things Gateway and its matrix layout technology[4]. This system consists of an Internet of Things gateway, a wireless intelligent sensor, a wireless control module, and a hollow routing device. The technical programmes are as follows:
The Internet of Things Gateway is the core support of the entire system. On the one hand, it receives the acquisition information uploaded by the perceptual network and controls various devices in the temperature room according to the instructions. On the other hand, it uses the router protocol to communicate with the traditional network to upload the collected data. Once a sensor in the graph communicates with the gateway, it can indirectly transmit the data to the system gateway by means of the surrounding sensors, which will virtually increase the reliability of the entire system communication; There is a wireless control module next to each wireless intelligent sensor module. The role of this module is to control the opening and closing of the corresponding device according to the instructions of the gateway. In addition, the role of hollow routing is to act as a bridge when the Gateway and the sensor or control module cannot communicate directly, ensuring that the entire system communication has a blind spot[5].

4.2 Design Model of Application Layer of Agricultural Properties Network Based on Loose-coupled Layering Technology

The design of the agricultural Internet of Things technology system communicates through a unified interface between layers, uses communication methods such as sharing database data and calling operating system functions, and develops in different modules in the business logic layer in the form of plug-ins. The advantage of this design is that it is not necessary to rewrite the system

when the technology is newly integrated later, but rather to make some changes to complete the integration of new technologies. In order to maintain the flexibility of subsequent development, the design system must retain flexibility and sociability. Different languages are used for development between each layer. Good compatibility can effectively improve development efficiency.

4.3 Development of an intelligent application platform for agricultural greenhouses using virtualization technology and cloud platforms

Once the agricultural objects network platform is established, huge data processing will be a problem. For many poorly educated farmers, the processing of these data is extremely difficult, even for some agricultural experts. In the face of such large data can only make some qualitative judgments. The solution is to store the data in the cloud, so that it does not cost a lot of money to establish a calculation center. At the same time, it can also provide evidence and basis for future monitoring of plant growth environment and growth process, food safety tracing, and other behaviors.

The most important thing to collect data to store in the cloud is the communication problem of data. The number of Internet of Things gateways in agricultural Internet of Things systems is very large, and these Internet of Things gateways must correspond to IP addresses for communication with cloud servers, but this is not realistic. After all, assigning IP addresses to such a large number of networks occupies too many network resources. The solution is the LAN intranet address. Through these virtual IP, the gateway can transmit data to the server.

5. APPLICATION OF THE AGRICULTURAL THINGS NETWORK SYSTEM

5.1 Field information monitoring using Internet of Things technology

Using the Internet of Things technology, myopia information on crop growth can be fed back to farmers, and it is not limited by time and space. This will greatly reduce the economic losses caused by the changes in the natural environment of crops, especially the current greenhouse vegetable cultivation. This type of agricultural cultivation is very expensive, and management needs to be more refined. The temperature in the shed, the wind outside, especially the hail in summer, and fertilization and ventilation can cause the growth of vegetables. The use of Internet of Things technology to monitor these indicators can make it more scientific and reasonable to grow crops.

5.2 Control of farmland management using Internet of Things technology

The popularization and application of agricultural objects network technology will gradually liberate human labor, establish agricultural machinery system and software control system through the information organization method change the previous wild management model in production, and achieve the refined management of crops. The monitoring of information on crops and poultry, the timely determination of the amount of fertilizer needed for crop growth, and the feed needed for poultry farming, will reduce waste and fertilizer pesticide pollution, but will also ensure the normal growth of crops and poultry.

Through the inspection of the growth of crops can be timely management, increase fertilizer, irrigation and other more suitable. In domestic livestock breeding, multiple life indicators can be monitored to detect livestock outbreaks in a timely manner, prevent and control them in a timely manner, and reduce the risk of breeding. For the light control of the shed, the remote technology can be used to automatically adjust the curtain according to the demand of crops and automatically carry out crop drip irrigation. This can greatly reduce the workload of workers and is an intensive direction of agricultural development.

5.3 Use of Internet of Things technology for safety trace-ability of agricultural products

With the improvement of people's living standards, residents pay more and more attention to the health and pollution-free problems of agricultural products, which puts forward a severe test for the quality supervision of agricultural products. The whole production process of agricultural products can be comprehensively detected by means of the Internet of Things information collection technology, which is widely distributed in farmland, and the retroactive management will be extended to the enterprises 'internal and field heads, while the whole production information recording system of agricultural products within enterprises is well documented. Strict production quality of agricultural products. Using developed Internet technology can easily query the entire production process of food, allowing consumers to supervise the safety of food and feedback food issues to ensure food quality.

5.4 Farmers 'education through Internet of Things technology

The use of Internet of Things technology can reduce the number of farmers directly engaged in manual labor, but the use of a large number of Internet of Things technologies and equipment will create new jobs, which is an industrial upgrade in rural areas. On the other hand, using the distance education technology of the Internet of Things can improve farmers 'technical knowledge, popularize the use of the Internet of Things, and further enhance the modernization of agriculture. The application of the Internet of Things technology can increase crop yields, and it can change farmers 'income structure and increase farmers' income.

6. CONCLUSION

Therefore, agricultural intelligent information platform needs both the Internet of Things and the support of agricultural cloud computing. It is an application system built using a variety of technologies. The information platform based on the Internet of things and cloud computing service can speed up the informatization construction of agriculture, raise the informatization level and accelerate the economic development.

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