

# APPLICATION AND PROSPECTS OF ICT IN PRECISION AGRICULTURE

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**Abstract:** In order to solve China's agricultural problems and food problems, improve China's current situation of more people, less land and resource shortages, and ensure people's food security, "precision agriculture" came into being. ICT, as the core of the development of precision agriculture, is very important for precision agriculture. Extremely important. This article will use this title as a brief discussion of the meaning and role of ICT and precision agriculture, the application and prospects of ICT in precision agriculture, and predict the future development trend of ICT in precision agriculture.

**Keywords:** ICT; Precision agriculture; Application; Prospect

## 1 OVERVIEW OF ICT AND PRECISION AGRICULTURE

The development of precision agriculture has become the primary goal of my country's agriculture. It can ensure that national food problems, land problems, agricultural problems, etc. are effectively solved. The development of precision agriculture requires the support of advanced science and technology. my country's rapid development of science and technology and the great success of 3S technology in recent years have happened to provide technical support for precision agriculture. ICT is closely integrated with precision agriculture to promote the smooth progress of precision agriculture. Its application in precision agriculture has become an inevitable trend in agricultural development.

### 1.1 ICT Overview

ICT is the abbreviation of information and communication technology. It is a technical service that can access, store, process and other operations on information. ICT is a series of electronic technologies that have a certain degree of plasticity after being combined by new institutions. It strengthens the connection between information technology and communication technology, allowing people to collect, manage, and share information through different devices. , is a new model of integration between information technology and communication technology.

Judging from the current application fields of ICT, it is widely used in the fields of education and business, and has less application and promotion in the agricultural field. However, with the emergence of agricultural problems, food problems, and the development of communication technology and information technology, the realization of The application of ICT in the agricultural field is an inevitable result. At the beginning of the emergence of information technology and communication technology, both were relatively independent concepts. Information technology refers to the collection, utilization, storage and other operations of information through computers and other equipment, and communication technology refers to the transmission of information through electronic means. However, in With the development and progress of society, coupled with the needs of people's production activities, the boundaries between information technology and communication technology are gradually being broken. The two are getting closer and closer in application integration, gradually realizing broadband, and slowly integrating. A new ICT model has been formed, so that information resources are no longer simply brought together, but information can be collected, organized, integrated, utilized, etc. through ICT, so that information resources can be fully utilized and disseminated. ICT can be divided into software and hardware facilities. Software facilities include email, electronic journals, forums, WeChat and other applications. Hardware facilities include computer networks, storage, mobile phones, computers and other equipment. The mutual combination and cooperation capabilities between software and hardware Let information be better managed, disseminated and utilized.

### 1.2 Precision Agriculture Overview

Precision agriculture is a modern agricultural concept that emerged under the increasingly serious agricultural and food problems. It refers to more precise management in the field management process, that is, targeted fertilization according to the different characteristics of field crops and soil. and giving different amounts of fertilizer [1]. In traditional agricultural management, uniform standards are used for fertilizing and watering crops, ignoring the different requirements for the amount of fertilizer and the different requirements for fertilization and watering time among different crops, causing resources to be wasted. Excessive use of fertilizers on fertile land will flow into groundwater, causing environmental pollution. In this regard, in order to obtain better harvests, reduce unreasonable resources during crop planting and protect the environment, precision agriculture has emerged, which determines the quality of each crop based on the differences and differences between field crops and field soil. management work to increase crop yields,

reduce planting costs, protect the farmland environment, and achieve long-term sustainable development of the planting industry [2].

If precision agriculture can be effectively carried out, it needs to rely on modern technology for support. 3S technology can be used to obtain field data to provide technical support for crop production management decision-making. A variety of data collected through information technology equipment can make better decisions. Accurate and more scientific decision-making can satisfy the differences in crop growth in the field and increase yields.

## **2 THE COMPOSITION AND DEVELOPMENT OF ICT**

### **2.1 Wireless Sensor Network**

Wireless sensor network is one of the important components of ICT, which allows people to obtain the information they want and utilize the information at any time, place and environment. Driven by the development of science and technology, this kind of wireless sensor network with intelligent acquisition and processing of information is a period of rapid development of modern sensors, modern networks, wireless communication technology, etc., the development and integration of various emerging technologies and the emergence of new techniques have provided wireless transmission. The development of sensor networks has provided opportunities. Sensing technology has begun to develop towards wireless and intelligent aspects. Various types of micro-sensors with sensing, communication and other functions have been developed. A huge wireless network is formed through micro-sensors arranged at nodes in various areas. Sensor networks provide good conditions for information collection and dissemination. Through the formed wireless sensor network, real-time signal collection, detection, information dissemination and utilization can be realized, allowing people to obtain and apply the required information within the coverage of the wireless sensor network.

### **2.2 Internet of Things**

The Internet of Things, like wireless sensor networks, is an indispensable part of ICT applications. It achieves the integration of information technology and industry expertise through interconnected applications among the perception layer, network layer, and application layer. Provide information services based on industry needs. The current Internet of Things has not yet established a standard and open system architecture. It is simply divided into three levels: perception layer, network layer, and application layer. The perception layer mainly solves the problem of information perception and identification. With RFID Tags, sensor networks, cameras and other reading devices are used to sense and collect information. The network layer mainly carries out information transmission. During the information transmission process, communication networks, Internet networks and other converged networks are used to manage and process information, thereby realizing connection services between the perception layer and the application layer. In the application layer, the final effective combination of information technology, communication technology, industry needs, and professional technical requirements is realized, information decision-making is completed, and characteristic services are provided for industry needs.

### **2.3 Cloud Computing and Cloud Services**

In ICT, cloud computing and cloud services are very important to it. It relies on open standards and the Internet as an operation center to operate, providing users with more secure cloud computing services and achieving effective data information storage; cloud services allow Users can realize fast services that can be operated without storing or accessing the Internet. The requirements for the computer configuration used by users are not high, giving users a cheaper information service experience. ICT composed of cloud computing and cloud services can rely on this feature to better Meet the information needs of precision agricultural production applications [3].

The architecture of cloud computing and cloud services can be divided into three levels, namely infrastructure, platform service architecture, and software service architecture. Infrastructure refers to various types of virtual servers and software, which can be used to supplement database information. The platform service architecture allows users to run programs in virtual servers without having to consider the maintenance of the running system. The software service architecture provides users with the basic functions of traditional applications and solves the basic needs of users in the application process [4-5].

### **2.4 Beidou Satellite Navigation System**

The Beidou satellite navigation system is one of the four major satellite positioning systems in the world. It is a regional satellite positioning system independently developed by China. The emergence of the Beidou satellite navigation system provides strong support for communication technology and improves the coverage of the navigation system. , more independent, it can provide users with two service forms: open service and authorized service. Users can choose which service form to apply according to their needs. Open service allows users to achieve positioning, timing and other services in the service area, while authorized service The service is to provide users with more accurate and secure positioning, timing and other services. The application of the Beidou satellite navigation system in precision agriculture can provide more efficient and safer navigation and positioning services for agriculture, ensure the integrity and security of its system information, and achieve effective field management of crops.

## 2.5 IPv6

IPv6 was born to solve the address space problem. It is the sixth version of the Internet Protocol. Our country is currently in the process of transition from IPv4 to IPv6 in order to realize the interconnection of the next generation of high-speed networks. Compared with IPv4, IPv6 uses 32-bit binary as address encoding, and the address space is wider than IPv4. Its application in ICT can provide a wider space for information storage and dissemination.

## 3 APPLICATION AND PROSPECTS OF ICT IN PRECISION AGRICULTURE

### 3.1 Application and Prospects of Internet of Things and Wireless Sensing in Precision Agriculture

The Internet of Things and wireless sensing in ICT are the most widely used in precision agriculture. It allows precision agriculture production managers and technical operators to obtain relevant agricultural planting information, plant crops based on the obtained information, and conduct crop inspections. Conduct real-time supervision of the planting situation, predict problems that crops may encounter during the growth process, and scientifically prevent and control crop diseases and pests. The application of the Internet of Things and wireless sensing in precision agricultural production relies on environmental monitoring nodes and communication systems deployed in farmland. It can form a wireless sensor network in farmland to monitor farmland conditions, climate change, and crops. Collect and monitor information such as growth conditions, etc., and transmit this information to the information monitoring center through various transmission networks. The information monitoring center can receive and analyze the transmitted information, and perform visual processing of the information to provide precision agriculture planting. Decision-making reference to achieve reasonable and scientific precision agricultural production [6-7]. At present, the state and government have put forward clear directions and formulated reasonable strategic goals for the construction of the agricultural Internet of Things. The construction of the agricultural Internet of Things should be carried out in accordance with the instructions of the state and government, integrating agricultural development and the construction of the agricultural Internet of Things with national conditions and technology, and proceeding steadily. When our country is building the agricultural Internet of Things and wireless sensing, in addition to doing a good job in basic top-level design, it is also necessary to manage and improve the actual application, so that the basic top-level design work and actual application work can meet the actual needs of precision agricultural production. demand to promote the application and development of the Internet of Things and wireless sensing in precision agriculture. In addition, each thing is also required to have its own IP address, so that IoT users can access any thing through the IP address. Therefore, the development of the Internet of Things still requires a large amount of address space to build IP for things, and IPv6, which is currently being transformed in my country, can just meet the address space needs of the development of the Internet of Things and provide technical support for the construction and development of the Internet of Things. Therefore, our country must accelerate the development of IPv6 Transformational applications.

### 3.2 Application and Prospects of Cloud Computing and Cloud Services in Precision Agriculture

The application of cloud computing and cloud services in ICT in precision agriculture can provide a more complete and convenient information platform for precision agriculture, solve the problems of dispersion and lag of agricultural information, realize efficient sharing of information in the agricultural field, and provide more scientific information for precision agriculture. A reasonable reference basis can achieve the purpose of producing according to the characteristics of crops, improve resource utilization, reduce the waste of crop growth resources, and highly improve the comprehensive benefits of farmland. The level of agricultural information technology in our country is not high, and the quantity and quality of agricultural information cannot meet the needs of scientific production, planting, and management of precision agriculture. The application of cloud computing and cloud services in precision agriculture is to solve this problem, based on the agricultural database. Established to provide sophisticated information resources for agricultural planting and accelerate the cloud informatization of information technology in the agricultural field. At the same time, the application of cloud computing and cloud services in precision agriculture can reduce the maintenance costs and application costs of software and hardware for users, allowing users to obtain efficient services at low prices. In order for cloud computing and cloud services to be effectively applied in precision agricultural production, it is first necessary to gradually improve the standards for sharing various resources in precision agriculture, standardize precision agricultural production management, and strengthen the relationship between precision agricultural production and other related industries. Information connection, to obtain information on a larger scale, and to prepare for the sharing of information resources with the standardization and normalization of precision agricultural resource information. Then according to the standard, we can build a low-cost but flexible and convenient cloud service provider public cloud model, or a relatively independent, complete and highly targeted private cloud model, and a hybrid cloud model that is both independent, flexible and shared. Choose the cloud based on the actual situation of precision agricultural production. Model is constructed to create a simple-to-operate cloud service platform for user access and provide users with corresponding cloud services.

### 3.3 Application and Prospects of Beidou Satellite Navigation System in Precision Agriculture

One of the main purposes of the application of Beidou satellite navigation system in precision agriculture is to obtain the coordinate information of farmland soil sampling specimens, so that agricultural machinery can automatically lock the operation position when performing relevant operations on farmland, perform operation positioning and precise construction; understand the farmland terrain The situation and crop conditions as well as the corresponding farmland coordinate information provide accurate locations for farmland management in precision agriculture [8]. In order to better achieve precise production and construction of precision agriculture, precision agricultural construction machinery needs to work with the help of the Beidou satellite navigation system, so that precision agricultural construction machinery can locate at any time during field construction, obtain field operation information, and collect field terrain The ups and downs of information are transmitted to the resource platform. In the subsequent sowing and fertilizing processes, precise sowing and fertilizer delivery can be carried out based on this information, reducing the waste of water, fertilizer and pesticides in agricultural production, and improving the overall efficiency of farmland planting. Increase crop yields.

The Beidou satellite navigation system can provide users with safer and more accurate positioning services, and its application in precision agriculture can greatly promote the realization of precision agricultural production purposes; at the same time, the Beidou satellite navigation system can also promote the Beidou satellite navigation system in precision agriculture applications. Industrial application and promotion of navigation systems [9-10].

#### 4 CONCLUSION

The application of ICT in precision agriculture can achieve the production purpose of precision agriculture, build a reference information system model for precision agriculture, provide an information resource acquisition platform with efficient services, collect information through the information perception layer, and use the information management layer to carry out precision agriculture. Cloud computing and IoT management allow users to meet differentiated precision agriculture information needs, provide users with visual services, and promote the effective development of precision agriculture.

#### COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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