

Application of Intelligent Agriculture Based on Internet of Things

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Abstract— In recent years, with the rapid development of big data and artificial intelligence, starting from the concept and key technologies of the Internet of Things, this paper discusses the application and application of the Internet of Things technology in agriculture, and discusses some of the problems, and gives the corresponding countermeasures, such as sensor technology, RFID Technology and ZigBee. On this side, combining the experience of agricultural development and the current situation of agriculture, corresponding suggestions are provided for the development of agriculture, so as to promote the healthy development of Internet of Things technology in agriculture.

Keywords— Internet of Things; Agricultural Development; Sensor Technology; RFID Technology; ZigBee.

I. INTRODUCTION

Recently, with the improvement of residents' quality of life, The Internet of Things technology has been widely used in various areas [1-3]. While people enjoy the convenience brought by the emerging technology of the Internet of Things, the development of the Internet of Things is very slow in agriculture, and the Internet of Things technology will have great development potential. In order to accelerate the process of agricultural modernization, the application of Internet of Things in agriculture is an indispensable part of agricultural development [4].

In the process of promoting agricultural modernization, the implementation of "Internet of Things" (IoT) is an important means to realize the development of intelligent agriculture. By introducing IoT technology into agriculture, it can effectively improve the quality of agricultural products, thus greatly reducing the cost of agriculture [5]. However, due to the lack of understanding or belief in the IoT technology, and the reluctance of highly educated young people to stay in their hometown and engage in the agricultural industry, most of the main crop cultivation still relies on traditional agriculture, the application degree of IoT technology in agriculture is not enough, and the popularization scope of smart agriculture is not wide [6].

In order to further promote the intelligent development of agriculture, it is necessary to apply the IoT technology to the production process of agriculture in a planned way, so as to achieve the purpose of developing agriculture more effectively, reducing agricultural costs, and improving farmers' living standards. Sensor-based IoT basic technology is an important means for the digital transformation of traditional industries such as agriculture, industry, and service, which can enhance the added value and competitiveness of

traditional enterprises [7-9]. Taking the Agricultural IoT as an example, the application of sensors makes it possible to refine and digitize agricultural production and provide efficient and reliable monitoring and management services for producers, operators, and government departments through the collection, transmission, processing, and analysis of agricultural production environment data.

II. OVERVIEW OF IOT

This section mainly focuses on some technologies related to the IoT, which expounds on the IoT technology, ZigBee wireless communication technology, sensor technology and other aspects in detail. The above technologies are described in detail, which lays a foundation for the further development of agricultural IoT technology.

(1) Sensor Technology

Sensor is a kind of process detection device, can be detected in the process of measured information, namely through internal sensor acquisition of external signals, convert to physical quantities into an electrical signal to the output, in order to meet the needs of the information collection, in the information transmission, acquisition, storage, display and control are used [10]. The working principle of the sensor is to sense all kinds of information from the outside world and then directly enter the conversion element after passing through the sensitive element. Some sensors directly enter the conversion circuit after sensing the external information through the induction element, and finally output in the form of electrical signals.

Because of the existence of the sensor, people can access to natural and production of all kinds of information data, in the current era of rapid development of science and technology, the sensor has been used in all aspects of life, in agriculture, soil moisture, temperature, the process of agricultural production, a variety of factors such as water collection is implemented by sensors, The sensor environment is more complex and sensitive, so the requirements of the sensor are higher and higher [11]. In the next few years, there will be more and more high-precision and high-purpose sensors will be applied to agricultural production, so as to further develop China's agricultural modernization process.

(2) RFID Technology

RFID technology is a combination of non-contact automatic identification and automatic identification of radio frequency signals [12]. As a very important radio frequency

technology in the Internet of things, RFID is still in the initial stage of development, and related technologies are still being improved. At the same time, some of its drawbacks are also constantly emerging, RFID technology security and privacy is a very important issue, which is related to the safety and interests of every user. RFID technology is an important technology in the field of wireless sensor. The core components of RFID include RFID chips, coils, circuits and components. At present, there are three types of RFID identification: active, passive and semi-active.

(a) Active RFID tag is also known as "active RFID tag", its core component is powered by batteries. The way it works is that after the active tag receives an indication from the reader-writer, the tag sends the stored information to the reader-writer.

(b) Passive RFID tag is a new RFID technology, also known as "passive RFID tag". RFID reader is the use of RF reader antenna, in a certain range of electromagnetic induction, when the RFID tag close to the reading and writing equipment, through the electromagnetic field generated by the electromagnetic field, so that the RFID chip work. The chip transmits the information on the tag to the reader and writer through the RFID tag antenna.

(c) Semi-active RFID indicates that there is no power supply in RFID, but the effective identification distance is still very short. Semi-active RFID is a compromise between active and passive contradiction. In general, semi-active RFID is dormant and only provides data stored on the tag, so it has low power consumption and can be repaired for a long time.

RFID system consists of antenna, tag, read out three parts, each part has its own code. The contactless identification ability of RFID technology is to use the electromagnetic coupling principle of radio frequency signal in the propagation process to achieve the acquisition of target information and data transmission, so as to achieve the purpose of automatic identification of the target object. RFID technology achieves the collection and transmission of project information without human interference. RFID technology is a remote contactless, small size, large storage information, anti-pollution, can be read and written repeatedly, strong penetration and other advantages. Therefore, RFID technology can be used to collect data in different crop production cycles. Agricultural practitioners can intuitively understand the growth of agricultural products.

(3) *ZigBee wireless network communication Technology*

ZigBee is a low-rate wireless communication technology [13]. ZigBee's wireless network communication technology is based on the "Z" shape, also known as the so-called Purple Peak wireless network technology. The system has the advantages of high reliability, short distance, high flexibility and low cost. The technology is open source, so most people like it. Moreover, it can also carry out short-distance communication within the range of dozens of meters to hundreds of meters, which is very suitable for the internal environment of the greenhouse.

ZigBee's wireless network communication technology is very cheap, and includes many communication networks that

carry information without wires. Communication devices, such as mobile communications, and wireless access communications. CSM and CDMA in ZigBee wireless networks work in much the same way, in that the base station and transmitting module function the same, but in a distant place [14-16]. Ten meters to a few hundred meters, in today's technology, can even span several kilometers. The letter must have an agreement in mind. The working frequency of ZigBee is around 24 GHz and the operating speed is above 10 Mbps. Therefore, the effectiveness and distance of communication must be fully taken into account when using ZigBee for wireless communication.

III. APPLICATION OF IOT IN SMART AGRICULTURE

Smart agriculture is an important embodiment of agricultural modernization. It takes "agriculture + Internet of Things + big data + cloud computing" as the core of "smart agriculture" [17]. The monitoring function and control function realized by wireless sensor transmission system form the operation of intelligent control of agricultural information, realize the accurate monitoring and remote control of agricultural production, as well as the processing of emergencies. One of the most prominent features is the use of IoT-related technologies to promote agriculture.

(1) *Application of Internet of Things technology in smart agriculture monitoring*

Agricultural supervision is mainly agricultural ecological environment supervision, agricultural ecological environment supervision is to ensure the safety and quality of agricultural products, so it plays a very important role in agricultural production management [18]. In the traditional production mode, agricultural environmental supervision is carried out manually, which is time-consuming and laborious and difficult to achieve good regulatory effects. With the application of Internet of Things technology in agriculture, farmland environmental data and information can be collected accurately and quickly, and the collected information can also be processed and analyzed automatically. Thus, it can help agricultural managers to timely understand the growth state of crops, so that they can timely take relevant measures and improvement methods, so that the farmland environment to maintain a good state.

Additionally, crop environmental monitoring system based on Internet of Things has been widely adopted, which can monitor crops in real time. Practice shows that the Internet of Things technology has achieved good results in soil, atmosphere and other aspects of control, and in the agricultural field, through the use of the Internet of Things, can timely grasp all kinds of emergencies, reduce the labor intensity of farmers, improve food production, greatly increase farmers' income.

(2) *Application of Internet of Things technology in agricultural irrigation*

At present, the country and farmers are increasingly investing in agricultural production technology and improving the utilization of water and soil resources. However, in the actual agricultural production process, the utilization rate of

resources is very low. And as the shortage of water resources becomes more and more serious, we must make effective use of water resources, which is an important step in the development of agriculture [19].

Compared with traditional irrigation methods, the use of Internet of Things technology has a great role in promoting agricultural irrigation. In agricultural irrigation, the Internet of things technology can be used to realize automatic irrigation through the whole operation and control of mobile terminal equipment. The system firstly collects data of soil water content and other indexes, analyzes and processes the collected information intelligently, and determines the irrigation method and water consumption according to the integrated information. When the soil water content is lower than the standard index, intelligent irrigation equipment is used to implement fine irrigation to ensure the irrigation quality. In smart agricultural irrigation, the application of Internet of Things technology will continuously optimize irrigation efficiency and increase the effective utilization rate of water resources. Finally, an agricultural irrigation water-saving platform with high efficiency and low energy consumption will be achieved, and the refinement of modern agriculture will be realized to obtain better production results.

IV. EXISTING PROBLEMS IN THE DEVELOPMENT OF SMART AGRICULTURE

(1) Lack of talents in the development of smart agriculture

Problems existing in the development of smart agriculture at present, the degree of new technical knowledge such as sales and management is relatively low. The level of agricultural production technology has a great influence on the quality of agricultural production. Due to the limitation of education level, they do not have a deep understanding of new technologies and are not familiar with the equipment and technology used, which makes it difficult to promote the Internet of Things technology to grass-roots level and lack of specialized operators, which brings great obstacles to the development of agriculture [20].

In addition, due to the lack of knowledge of the Internet of things and other aspects of agricultural production frontline personnel, farmers have a low educational level and do not carry out agricultural vocational education well, resulting in the lack of use of network technology and learning atmosphere in rural areas. In modern agricultural production and management, there is a lack of interdisciplinary talents with Internet of things technology and agricultural production technology. And, with the development of the society, more and more youth set out to agricultural industry, there are more and more college students in rural areas. They have their own professional knowledge and skills, for the application and maintenance of Internet of things have a certain understanding, however, because the government and the national home entrepreneurship for college students and employment support is insufficient, more and more college students go to cities to work in high-tech industries, so they don't want to go back to their hometown to work in agriculture.

(2) The scale level of agricultural production is not high and the application degree of agricultural facilities is low

With traditional agriculture as the main input, more labor and capital, land is scattered in the hands of farmers, mainly in the family as a unit to sell manpower for the cultivation of agricultural products, in the main body of agricultural production, small farmers account for 98%, farmers account for the vast majority of agricultural population, and small farmers occupy more arable land. Small-scale farmers mostly rely on artificial, animal husbandry and other traditional agricultural production methods. Single variety of agricultural products, it is difficult to achieve large-scale and systematic agricultural production [21].

At present, agricultural infrastructure in most places is still very backward and there is no large-scale modern agricultural machinery. Mainly displays in: rural road is narrow and rugged, more rain is muddy, in most of the water conservancy facilities are simple sewers, drains, only adopt the mode of traditional flood irrigation, and efficient pipeline irrigation need only locally built, caused a lot of waste of water resources and land harden. Traditional agriculture does not require much productivity, which means that there is no need for a high degree of mechanization or intelligent machinery to assist production, for one thing, they haven't realized the value of backup equipment. In addition, due to the low market input of agricultural machinery and tools, high prices, low national subsidies and other reasons, it is difficult for small and scattered small-scale agricultural producers to buy, and many modern agricultural machineries cannot enter the farmland.

V. COUNTERMEASURES IN THE DEVELOPMENT OF INTELLIGENT AGRICULTURE

(1) Promote large-scale informationized agricultural production

Strengthen the communication and contact with farmers, so that scattered individual farmers become an active group. In order to integrate land resources effectively, collective production and management system must be established [22]. We will promote demonstrations of smart agriculture and guide the development of large-scale agriculture. Meanwhile, increasing the mechanization of agricultural machinery, increasing input in agricultural machinery, vigorously developing agricultural machinery and other production methods, and promoting the mechanization of grain production.

In view of the development goal and stage of intelligent agriculture, the government should have a systematic plan and establish a sound information service system. Strengthen the construction of agricultural informatization in rural areas and speed up the construction of fast communication network between rural and rural areas. We will promote the spread of computers, mobile phones and other equipment in rural areas, so that farmers can access information quickly and accurately through the Internet, telecommunications networks and other channels.

Therefore, in order to completely change the scattered agricultural information resources, it is necessary to integrate

agricultural, water conservancy, pest and disease monitoring information, build a large agricultural information platform, and gradually realize the interconnection of agricultural information.

(2) Policies will increase investment in smart agriculture

The development of smart agriculture requires extensive use of advanced technology and equipment. As we all know, farmers' incomes are low, and smart agriculture costs a lot to operate and maintain. It is necessary to strengthen the support of the government, to raise funds, it is necessary to have policy support [23]. On the other hand, the state should formulate relevant policies to encourage enterprises to participate in smart agriculture and introduce social funds into smart agriculture [24]. Only truly understand the value of intelligent agriculture, understand the value of intelligent agriculture, their investment enthusiasm will be inspired.

Although the quality of agricultural products has been improved under the intelligent production mode, in the market with asymmetric information, consumers may not be able to recognize these excellent qualities in time, thus affecting the price they are willing to pay. Therefore, the establishment of "agricultural brand" can be used as a way to increase farmers' income. By creating "agricultural brand", consumers can have a deeper understanding of "intelligent agriculture", so as to achieve the purpose of "characteristics" and "quality", so as to achieve the "increase in income" of farmers. At the same time, it is also an important means to develop intelligent agriculture.

(3) Talent cultivation mechanism of new farmers

In new type of farmers, the talent training mechanism of the government should intensify publicity, give full play to the intelligent agriculture demonstration leading role, in intelligent agricultural development planning configuration required technical talent, on this basis, focused on strengthening the cultivation of the agricultural technical personnel with the ascension of farmers' overall quality, to make farmers aware of the importance of intelligent agriculture [25-27]. At the same time, we should give full play to the educational resources of schools, strengthen the training of highly skilled agricultural technical personnel, carry out the project of "college student village official", transport college graduates for villages, and improve the professional level of grass-roots agricultural technical personnel. Promote the popularization and application of agricultural informatization in rural areas.

Finally, to improve the comprehensive quality of rural labor force, the use of modern information technology [28], improve farmers' understanding of intelligent agriculture from multiple aspects and master, so they can get the technical guidance and policy in time, improve their professional technology and technical level, at the same time also can guide and inspire students were devoted to the agricultural production, have the effect of demonstrative leading, Promote the training of new professional farmers, improve their professional ability, so that they can better and faster adapt to the development of smart agriculture.

VI. CONCLUSION

In this paper, through the analysis of the theories and technologies related to the Internet of Things, this paper analyzes several fields that are most used in the agricultural field. As an important woven part of the new generation of information technology wood, Internet of Things technology wood has gradually been widely used in agriculture, the application of Internet of things technology, agricultural production mode has changed, production efficiency has been greatly liberated. However, as the Internet of Things technology is still in its infancy, its application in the agricultural field is still weak, and it lacks sufficient information and practical experience.

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