Intelligent Tea Garden Control Technology based on Internet of Things

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Abstract: Tea planting is one of traditional agriculture. With the development and progress of economy and imperial examination technology, the popularity of Internet of things technology is higher and higher, and the cultivation of tea is also affected by Internet of things technology. In the process of growing tea, the mode of operation and management has changed, and the quality of tea has also improved with the change of management mode. Therefore, the integration of tea planting and Internet of things technology to build an intelligent tea garden based on Internet of things and promote the modernization of tea is a new way out for China's tea. In addition, the intelligent tea garden based on Internet of things technology has effectively improved the comprehensive production capacity of the tea garden to a certain extent and the quality of tea as a whole. Based on the Internet of things technology, this paper constructs an intelligent tea garden control system to realize the fine management in the process of tea planting.

1. Introduction

Internet of things technology is a network technology based on the Internet, which realizes the real-time sharing of goods information through information sensing, wireless data communication and other related technologies, so as to realize the intelligent identification, positioning, tracking, monitoring and management of goods. With the development of information perception, collection technology, data transmission and processing technology, the application of Internet of things in agriculture has attracted more and more attention. Some technologies in the Internet of things system have been realized in facility agriculture, especially in agricultural developed countries such as the Netherlands, Israel, the United States and Japan. These countries have been able to systematically monitor and regulate the evolution of soil characteristics, plant ontology perception, fertilizer and water management, facility environment and other aspects according to the different needs of different crops for the environment through various intelligent sensing, monitoring and regulation equipment, and have formed a complete system of facility agricultural cultivation technology. In the context of the lack of rural labor force in China, the introduction of Internet of things technology into tea garden management is of great significance for establishing intelligent tea gardens, improving labor productivity, controlling the application amount of pesticides and chemical fertilizers, and ensuring the quality and safety of tea.

2. Application Value of Internet of Things Technology in Intelligent Tea Garden Management

Tea planting management based on Internet of things technology has great application value. From the various stages of tea production and cultivation, Internet of things technology can be used no matter in the stage of tea cultivation, tea harvest and tea sales. The use of Internet of things technology can not only finely manage the tea garden, but also improve the quality of tea to a certain extent.

Firstly, before planting tea, people can use the Internet of things technology to detect and analyze the surrounding environment of the tea garden. The sensor is used to detect the temperature and humidity of the tea garden environment and the components contained in the soil, which can be used as the basis for planting tea and the most appropriate tea varieties are selected for planting in the tea garden. At the same time, the data collected by tea planting experts in the past can also be used as the basis to formulate the most scientific and reasonable tea planting plan. In addition, it can

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also transform the soil environment of its planting according to the soil composition information detected by the Internet of things technology, such as adjusting the PH of the soil to prepare for the planting of tea.

Secondly, after the tea is planted, the intelligent terminal equipment based on Internet of things technology is used to collect the illumination, temperature and humidity, PH and other information of soil nodes in real time in the process of tea growth, and can also view the state of planted tea and the dry and wet state of soil through remote monitoring equipment. The combination of the two can greatly reduce the probability of collecting wrong information. At the same time, we can also learn from the relevant information data collected before, establish the database corresponding to tea growth, and send the corresponding prompt signals such as pest control and irrigation in combination with the real-time monitoring of the growth environment of tea planting. In this way, people can do a good job in the epidemic prevention of tea growth to the greatest extent, and ensure that tea trees can grow and produce tea in the most suitable environment, so as to effectively avoid the large-scale outbreak of diseases and pests in tea gardens.

Finally, in the harvest stage of tea maturity, people can analyze the quality and growth of tea planted in the tea garden through various information collected in the planting process. At the same time, they can also accurately calculate the harvest data of tea. In addition, Internet of things technology can also track the packaging and sales of tea, so as to provide decision-making basis for tea planting and sales.

3. Construction of Intelligent Tea Garden Control System Based on Internet of Things Technology

The system can give full play to the characteristics of multiple terminal nodes of Internet of things technology, carry out real-time measurement of multiple environmental factors such as tea growth environment and growth process, such as illumination, soil temperature and humidity, soil PH, and monitor the growth process of all tea in the whole tea garden. At the same time, ZigBee network technology can also be used to transmit the monitored information to the gateway, and then the transmission function of the network can be used to transmit the detected and monitored information to the data processing center to classify and store the collected data information, so as to establish a data information database for tea growth.

After the completion of the database, it is also necessary to constantly revise the tea growth database and growth professional database according to the follow-up feedback, and take this as the planting basis to carry out automatic irrigation, automatic spraying and automatic fertilization of tea. At the same time, it can also realize the intelligent prompt of pest removal, irrigation, tea picking and other information, and form a two-level distributed control network with decentralized data collection in the terminal stage and centralized management in the data processing center.

Internet of things smart tea garden control and management system is based on Internet of things technology and consists of three parts: service platform, data transmission network and terminal equipment.

3.1. Service Platform

The service platform consists of data processing center, storage server and WEB server. Experts can also use the system data to analyze a number of tea data indicators, and use remote video for monitoring. Tea farmers can use the function of real-time monitoring in the control system to master the planting environment in the tea garden at any time, and carry out the corresponding tea garden nursing work according to the corresponding lifting signal in the system.

3.2. Data Transmission Network

The data transmission network can use optical fiber, asymmetric data subscriber line, wireless LAN, network cable transmission 3G and 4G to realize the transmission function.

3.3. Terminal Equipment

The terminal equipment is composed of information collector and sensor installed in the tea garden. The information collector is realized by sensor information acquisition and monitoring or real-time video and image monitoring. The monitoring system directly obtains the real-time information in the tea planting environment in the tea garden through the network, such as the light intensity, temperature and humidity, soil PH, temperature and humidity, carbon dioxide concentration and other parameters in the tea growing process in the tea garden. The sensor monitoring system can also mine and classify the collected information according to the data of environmental information. The real-time video and image monitoring system can directly and effectively express the growth environment of tea and tea trees. Compared with the traditional planting process, only the relevant data in tea can be obtained, but the condition data of tea growth process can not be completely presented. The real-time data of tea growth can be presented more intuitively through image, video and other technical means. In this way, it is convenient for tea farmers to observe valuable information according to images and videos, such as color and growth during tea growth. Using the image and video monitoring system, the management staff will not be limited by regional conditions when watching tea picking, sprinkler irrigation and nursing, but can directly observe and master the detailed production situation of tea at the same time, instead of going to the site for management in person in the process of planting in the past. Therefore, sensors can be divided into the following three categories.

3.3.1. Temperature and Humidity Sensor

In the process of ensuring the healthy growth of tea, the temperature and humidity of the environment is one of the important conditions. Generally, the smart tea garden will choose to use Kunlun coast-101 based on 2.4G ZigBee protocol wireless temperature and humidity sensor. The physical picture is shown in Figure 1. Kunlun coast-101 has very strong anti-interference ability and more than 60000 network IDs. It has very strong networking ability, and has the function of collecting information and transmitting information at the same time. Its wireless temperature and humidity sensor can monitor the temperature and humidity of the corresponding node in real time. Through wireless ZigBee technology, the data information collected by each terminal can be automatically transmitted to the data processing center in the system.

Figure 1 Temperature and humidity sensor Kunlun coast-101

3.3.2. Soil PH Sensor

Soil is the carrier for tea to absorb water and nutrients during its growth. Because the soil contains many organic acids, inorganic acids, salts and other substances, and the contents of various substances are different, the soil shows different acidity and alkalinity. Acidity is usually used to characterize this property, that is, PH value is used to represent the acidity and alkalinity of the soil. At the same time, tea has very high requirements for the PH of its planting soil. Generally, the soil with PH value in the range of 6.5 ~ 7.5 is called neutral soil, and tea trees are suitable to grow in acidic soil, that is, the PH of the soil most suitable for tea planting is between 4.5-5.5. Acid soil provides suitable conditions for tea growth and the most ideal growth environment for tea roots.

However, when serious acidification occurs in the soil surface layer, artificial conditioning is needed to ensure that the soil acid and alkali are moderate and avoid affecting the absorption of nutrients by the tea roots due to serious acidification of the soil. Therefore, SYS-OSA14 soil PH sensor can be used to detect the PH of soil. The soil PH value sensor can well solve the shortcomings of traditional soil PH value measurement, such as professional display instrument, difficult to carry, high power consumption, complex calibration and difficult integration. It can also realize continuous measurement of soil PH value, and has the advantages of high reliability and convenience.

3.3.3. Light Intensity Sensor

As the tea garden is often in a remote and complex environment, it is necessary to select the FR-IS light intensity sensor which is easy to install, has a wide measurement range and is suitable for all kinds of harsh environments. The sensor takes light through the silicon blue photovoltaic detector with filter. Because it also has high sensitivity to weak light, it has high measurement sensitivity and can measure the lighting light in Lux (1 foot candle=10.764lux). Moreover, the shell is made of special materials, with good waterproof performance and anti-corrosion performance and convenient use. The physical drawing is shown in Figure 2. In addition, because the sensor converts the light intensity into current signal, and then converts it into standard signal for output through operational amplifier, it is suitable for medium and long-distance transmission in large-area tea garden. The sensor can detect the light intensity in the tea growing environment in real time. At the same time, it can automatically compare the collected data with the database of light intensity in the expert system, and automatically perform shading, lighting and other actions to compensate the light intensity, so as to achieve the best growing environment.

Figure 2 FR-IS light intensity sensor

4. Conclusion

Internet of things technology is widely used. Applying Internet of things technology to tea planting and tea garden management and realizing fine management of tea garden is an inevitable trend in the development of times and science and technology. Nowadays, ZigBee technology has achieved remarkable results in agricultural automation and industrial automation, but in the process of practical application, ZigBee technology still needs to continue in-depth research and innovate and develop new technologies.

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