Research on Intelligent Measurement and Control System for Internet of Things in Greenhouse

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Abstract: With the continuous improvement of the level of agricultural informatization, China's greenhouse intelligent control system has gained many new development opportunities in technology and scale. However, compared with developed countries, China's greenhouse intelligent control technology is not stable. Based on past work experience, this paper summarizes the characteristics of intelligent measurement and control system for IoT greenhouses, and introduces the construction method of intelligent measurement and control system for greenhouse IOT through the actual design situation and content.

1. Introduction

At present, in the application of management technology in agricultural greenhouses, the advantages of the Internet of Things technology and the realization of the design and development of control systems have become a trend, which has changed the problem that traditional agriculture is restricted by many factors such as natural environment, regional environment and climate environment. The intelligent control system of greenhouse greenhouses helps the greenhouses to realize the development and application of intelligent agriculture in terms of temperature, humidity and environmental monitoring.

2. Characteristics of Intelligent Measurement and Control System for IoT Greenhouse

Adapt to the current needs of national economic development, agricultural and horticultural crops, healthy environmental factors, environmental utilization, etc., use greenhouse greenhouse intelligent control system to optimize environmental conditions such as light, temperature, humidity, gas factor, etc., to avoid traditional open-air cultivation conditions. We need to avoid adverse environmental impacts such as high winds, frost, and high temperatures to prevent crops from being reduced or rejected. In the greenhouse environment and the technical application of various equipment control technologies, the design and application of the overall structure of the intelligent control system is designed by using the Internet of Things technology, effectively improving the internal environment of the greenhouse, including temperature, humidity, light intensity and carbon dioxide. Concentration, etc., can be effectively controlled in technical application and system operation, which is beneficial to increase crop yield and quality [1]. The IOT greenhouse greenhouse intelligent measurement and control system realizes the unattended automatic operation of greenhouse greenhouses, reduces greenhouse energy consumption and operating costs, can provide an ideal growth environment for plants, and can reduce people's labor intensity and improve equipment utilization. Improve the greenhouse climate, reduce pests and diseases, increase crop yield, etc., and achieve intensive greenhouse and greenhouse remote management.
2.1 Intelligent Monitoring
The intelligent measurement and control technology of the IoT agricultural greenhouses has intelligent monitoring functions, which can realize the automation of information detection in the agricultural area. For example, through wireless sensor node settings, information collection and information routing devices, solar power supply systems, and wireless sensor transmission systems, parameters such as soil moisture, soil temperature, air humidity, temperature, light intensity, and plant nutrient content are transmitted through wireless sensing node is monitored. The wireless sensor aggregation node is implemented in the Internet of Things technology, and the data management function can quickly obtain the base test point information. Dynamic management, display, analysis and processing of environmental factors in greenhouses are formed, and intuitive charts and curves are transmitted to farmers. According to the needs of crops, the system provides various text messages or sound and light alarm information.

2.2 Real-time Control
According to the monitoring function system, according to parameters such as soil temperature, air humidity, temperature, light intensity, plant nutrients, etc. in the plant growth environment, the pH value and conductivity of the soil are selected. Through the wireless sensor aggregation node, the data storage display and management, feedback all kinds of information in an intuitive chart and curve, help the agricultural park to achieve automatic cooling, irrigation, film, liquid fertilizer, fertilization, etc. [2]. For example, water-saving irrigation design, wireless sensor automatic irrigation uses the communication function of the sensor under the set conditions, senses soil moisture, and realizes real-time communication of network information. The node includes a soil side collecting device, and a high-efficiency and low-energy water-saving irrigation platform is constructed to realize ecological water saving for the irrigation area of the farmland well, and a quantitative and integrated method is adopted for water-saving irrigation.

2.3 Application of Intelligent Technology
Intelligent measurement and control technology has various automatic monitoring technologies such as control system temperature, sensing temperature, PH value, and sensing ions. It can be proved by instruments and meters to prove that crops have a good living environment. For example, using advanced bio-simulation technology to simulate the environment of biological growth, computer monitoring and analysis of various environmental indicators, including monitoring water curtains, fans, sun visors in the greenhouse, and changing the biological growth environment inside the greenhouse. Technicians can remotely control in the office, monitor and control multiple greenhouses, and obtain the best conditions for plant growth through wireless network measurements, providing a scientific basis for the precise regulation of Wen's greenhouse. The sensor senses the moisture in the soil to realize automatic water saving and energy saving, and builds a low-energy, low-input, multi-functional agricultural water irrigation platform. The use of automatic timing measurement in the Internet of Things technology controls the timing of irrigation in real time, controls the amount of irrigation water, improves water use efficiency, and brings energy-saving effects to agricultural farming. Through continuous online monitoring of soil moisture, automatic control of water-saving irrigation can also be realized to provide a good growth environment for crops [3].

2.4 Management System Intelligence
The greenhouse greenhouse intelligent management system under the Internet of Things technology can complete the standardized network management of agriculture from production to quality inspection to transportation. Through RFID electronic tags, the growth process of crops enables full-scale monitoring and data management, from incubation to final transportation, real-time data transmission and management. In this process, physical quantity parameters show that crops have a good business environment through various instruments and meters, and can also adjust the production
cycle, improve economic efficiency, and ensure that agricultural production is truly networked, digitized and standardized.

3. Overall Scheme of Intelligent Measurement and Control System for Greenhouses Based on Internet of Things

According to the environmental control objectives and parameter characteristics of greenhouses, in order to achieve the goal of intelligent networked, scientific and automated production of greenhouses, the IoT technology support and greenhouse intelligent control system are used to comprehensively perceive greenhouse environmental parameters. The system requires a three-layer structure design as shown in Figure 1, namely the sensing layer, the transport layer and the application layer. The hardware mainly includes the field controller actuator and sensor. The sensor also includes the actuator and the field controller. The greenhouse control system is installed in the greenhouse. Each system can use Ethernet to access the local area network, implement a distributed control structure and through computer control system for control [4].

It can also be seen from Fig. 1 that the core of the greenhouse monitoring system based on the Internet of Things is mainly composed of a ZigBee router and an embedded gateway system, and the two can realize the effective transmission of information by means of the coordinator. In addition, the system can also be operated through the GPRS module and the wireless router to ensure that each node information can be transmitted through the sensor.

3.1 Perceived Effect

The greenhouse environmental information in the greenhouse is fully perceived through the sensing
layer, and the on-site control system is used to realize the automatic control and intelligent decision-making of the greenhouse. The Internet of Things provides a scientific basis for the automation control of greenhouses. Through different types of sensors, the air, humidity, temperature, carbon dioxide concentration, soil moisture, and light intensity in the greenhouse are sensed.

### 3.2 Network Transmission

The transport layer is built on the mobile Internet IoT LAN. Through the transport layer, the data transmission runs stably and the transmission is fast, and the remote application layer can be manipulated. In the transport layer, the combination of the Internet and GSM mobile communication technology can issue instructions to the sensing layer. Because the sensing layer acquires data, it transmits securely and reliably through the transport layer. The remote WAN can help users to obtain greenhouse environmental information anytime, anywhere. In the data transmission network, the remote wide area network and the greenhouse field network are designed according to the overall structure of the greenhouse. Through the mobile terminal and the web browser, the distance control between the centralized control computer and the field controller is implemented. Adopting Ethernet wired transmission mode, the network has a long distance, and has the characteristics of large capacity, stable operation, good robustness, wide coverage and flexible expansion [5].

### 3.3 Handling and Sharing All Kinds of Information in Greenhouses

The application layer can help the greenhouse to establish a good and reliable environmental information design. The application layer of the intelligent control system of the greenhouse can provide automatic control and processing of information in the disease control system, and accurately operate, providing a basis for decision-making guidance. After receiving the information, the sensing layer controls the computer to store the data. In the process of processing, the server software is used to carry out the database system, and the device state database and the greenhouse environment database are established. In the process of information processing of the Internet of Things, the data query technology data storage technology can be operated. In the intelligent processing process, the intelligentization of the greenhouse is given the function of intelligent processing. Intelligent control and intelligent processing technology Greenhouses are built on key technologies in the architecture of IoT technology. For example, using the mode control strategy, the greenhouse greenhouse control platform can perform variable structure fuzzy control on air temperature and humidity. This control method has the characteristics of good steady state and high precision, and can adopt intelligent control method to achieve reliability acquisition of environmental parameters.

Figure 2 Main Parameters of Intelligent Monitoring of Greenhouses
For the spatial data field and historical data, it can be obtained through the monitoring software installed on the mobile phone. The main parameters of the intelligent monitoring of the greenhouse in Figure 2 are shown, which facilitates the transmission of various data in the greenhouse and realizes the remote control operation. For temperature and humidity sensor applications, the main application types are air temperature sensors, blade loss sensors, soil moisture sensors and so on.

The technical application of avoiding errors in the IoT perception layer data can be preprocessed by using the software compensation distribution graph method and the averaging method. In the centralized monitoring program: the establishment of the cultivation knowledge base uses sql server software, the development of the management platform uses Lab View virtual instrument software, the centralized management and management platform adopts the human-computer interaction interface, and the output interface monitoring interface, setting interface, data management interface, etc. Intuitive management improves the management efficiency of greenhouses. The greenhouse greenhouse control system based on the Internet of Things technology provides relevant data for the scientific production of greenhouses through the centralized monitoring platform. The information suitable for the production conditions of various vegetable crops is stored in the knowledge base, and the greenhouse information network is released. It can also seek guidance from expert decision-making and adopt remote remote management.

4. Functional Application of Intelligent Measurement and Control System for Greenhouses Based on Internet of Things

4.1 Application of the Internet of Things Perception Layer
For the Internet of Things, the perception layer is the basis for the completion of related work, and it is the main tool for information transfer. Under normal circumstances, the sensing layer will realize the effective combination with intelligent objects through communication, recognition and other operations to form a new network. More importantly, the IoT transport layer can perform information exchange operations by means of a communication network, and collects distributed user terminals through transmission and switching devices to ensure connection between any users. Generally speaking, the important contents involved in the communication network are transmission equipment, terminal equipment, and switching equipment. The Internet of Things control layer is mainly to effectively process the on-site information, so that the intelligent control effect can be better displayed to ensure the automatic control of the field devices. For example, in the application process of sensor technology, the actual device can be detected and tested, and the correctness of the information can be felt. The electrical signal is outputted in the form of information according to a certain law, so as to satisfy the operations of recording and control, etc. to make favorable conditions for the execution of automatic control work.

4.2 Intelligent System Application
The wireless sensor can be controlled manually or automatically. The manual control mode can be manually controlled from the field controller and controlled by a combination of button relay and contactor. The automatic control is based on the field controller, and the operation of the centralized control management platform is carried out. In the automatic running state, remote mobile phones, remote browsers, etc. can be operated, and information of devices such as intermediate relays in the plc can be read and written. When automatic equipment control, the system can be switched by intelligent control and manual control. In the plc, for all monitored environmental factors, a centralized control computer is used to realize intelligent control of environmental factors. Switching between the two control modes or using a variety of control methods to ensure that the greenhouse environment is always at an appropriate level. With the help of wireless sensors, including ground temperature, soil moisture content, etc. can be coordinated to the best state, water saving, fertilizer, and medicine can reduce the overall energy consumption, up to 50%.
4.3 Diversified Production
The improvement of the environment is conducive to the diversification of crop cultivation, especially the high value-added economic crops can increase the output per unit area and increase production and income. For example, the online monitoring function can monitor various auxiliary equipment status, information environment parameter information and equipment status information in the greenhouse. Environmental factors affecting crop growth factors, such as air temperature, air humidity, light intensity, etc., through on-site control, display a centralized monitoring and management platform on the touch screen, remote control can be completed by SMS, remote query can be through a web browser carry out.

4.4 Application of Intelligent Technology in Agricultural Greenhouses
The workload of personnel is greatly reduced. Through centralized management, farmers can realize real-time control of the main functional modules of the greenhouse, monitor the output data setting parameter management, and adopt modular management of data collection to reduce the workload of the personnel. The operator can obtain the corresponding data through the sensing layer data. Multiple greenhouses are used for centralized control. Massive data can be stored. Farmers can monitor the operation status of the greenhouse through the module at any time. The data management module deletes and updates the database query, releases the decision and command of the centralized management platform, and realizes the setting of the high and low limits under the environmental parameters. Centralized monitoring of various management functions of the management platform, setting the target temperature and humidity values in the greenhouse to achieve scientific and efficient production of greenhouses.

5. Conclusion
Using the Internet of Things wireless sensor technology, greenhouse managers can view the crop growth environment at specific locations in the greenhouse through computer software and mobile phone software. In the application of Internet of Things technology, multiple greenhouses are linked in a wireless network, and the soil moisture, soil pH, air humidity, CO2 concentration, air temperature, soil temperature, and light intensity of multiple greenhouses are measured by wireless sensor modules. And a variety of parameters to collect. Then, the collected parameters are sent to the IoT intelligent gateway through the Internet of Things wireless network, and the data is transmitted to the computer and the mobile phone through the Internet and the network server. For the collected data storage, the software is analyzed by the computer, and the graph is displayed in the interface, which is convenient for the personnel to compare with the normal greenhouse parameters already stored in the database. At the same time, it automatically starts greenhouse control equipment such as liquid fertilisers, heaters, humidifiers, sunshades, etc., regulates the growth environment of greenhouse greenhouse crops, and maintains the optimal growth environment for crops.

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References
[1] Han Yue, Zhang Xiaojuan, Liu Pingzeng, et al. Research on intelligent measurement and control system of greenhouse Internet of Things in greenhouse [J]. Agricultural Technology and Equipment, 2017, (2): 18-20, 24.
[2] Qi Li. Characteristics and advantages of IoT agricultural intelligent measurement and control system and its application in greenhouses [J]. Anhui Agricultural Sciences, 2011, 39 (30): 18989-18992.
[3] Wang Yitao, Shao Zhengrong. Design of Greenhouse Remote Measurement and Control System Based on Internet of Things[J].Journal of Beijing Agricultural Vocational College,2014,28(5).
[4] Wu Xu. Research on greenhouse greenhouse measurement and control system based on Internet of Things technology [J]. Communication World, 2015, (24): 303-304.

[5] Cai anqi, Guo Jian. Research on greenhouse greenhouse measurement and control system based on Internet of Things technology [J]. Fujian Computer, 2015, (2): 80-81.