Design of Intelligent Greenhouse Information System Based on Internet Technology

Chang Su, Chao Yang, Lina Hu

Heilongjiang University of Technology, Jixi, Heilongjiang, 158100, China

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Abstract: The greenhouse information management system is the core of the intelligent greenhouse environmental monitoring system. Combined with the needs analysis of intelligent greenhouse management, visual studio was adopted. The net platform has developed an internet-based intelligent greenhouse information management system. The system is divided into functional modules such as user management, data management, real-time information monitoring, intelligent decision making, alarm display, and control, which enables automatic collection and intelligent control of environmental parameters such as greenhouse temperature, humidity, light, and CO2 concentration, and can Network monitoring through network terminals reduces labor management costs and increases the efficiency of greenhouse operations. The system is stable in operation, reliable in performance, and has certain popularization and application value.

1. Introduction

Greenhouse production is the best use of various advanced facilities and technologies to artificially create the best environmental conditions for plant growth and development. Through scientific management, it maximizes land productivity, resource utilization, and labor productivity. A new modern mode of agricultural production with good economic and social benefits. However, the greenhouse system has the characteristics of non-linear, time-varying, lagging, uncertain, multi-objective, and difficult to establish an accurate mathematical model, and the intelligent control can effectively control the above characteristics. The control theory is closely integrated with the actual production, and intelligent methods, intelligent technologies, and knowledge engineering methods are introduced to form different types of simple and practical control structures, forming human-machine intelligent systems including computer monitoring systems. In fact, the development of computer control technology provides an effective tool for the realization of this kind of intelligent control theory. The functions of the computer in processing images, symbol logic, fuzzy information, knowledge and experience, etc., can completely put the skilled operators, technicians, experts' knowledge, experience and operating methods into operation and control of the production process, so that To meet or exceed the human operating level, such control is called intelligent control. Smart greenhouses are characterized by high input, high output, high efficiency, and no pollution, and are the direction of greenhouse development [1].

2. Intelligent Greenhouse Information Management Technology Needs Analysis

Jiangsu Agricultural Expo Park is a modern agricultural production base integrating modern agricultural scientific research, production, and agricultural science and education. The Agricultural Museum of Modern Agriculture consists of a total of 4 modern glass greenhouses, including a shade net, wet curtain-fan system, and fill light. Lamps, automatic sprinkler systems, skylights, side windows and other institutions, before the transformation of the greenhouse completely rely on manual manual control, low degree of automation. Through this intelligent transformation, the four glass greenhouses will be centrally controlled and managed in a centralized manner. This will increase the intelligent management level of greenhouses, enable them to view, monitor and control greenhouses anytime, anywhere, and realize the automation, information, and intelligence of modern agricultural halls. Change. The specific control requirements are as follows: (1) The system

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can collect environmental factors such as temperature, humidity, light intensity, CO2 concentration, and soil moisture in the greenhouse in real time; and can automatically store environmental information, display real-time data, query historical data, and export environmental information data. Other functions. (2) Remote real-time video monitoring of the greenhouse production environment and real-time viewing of greenhouse conditions. (3) The system has remote network monitoring capabilities [2]. Administrators can use the Internet to inquire information about greenhouses, and use the Internet to remotely control greenhouse implementing agencies to achieve intelligent control of greenhouse environmental factors. (4) The system interface is friendly, easy to operate and manage. (5) To facilitate remote access management for customers, the system establishes user login management and divides users' rights. Different users are given different rights such as data browsing, query, modification, parameter setting, and organization control. (6) The system has stable performance and high reliability. It can ensure uninterrupted and trouble-free operation for a long time.

3. Internet-Based System Software Design

System software uses visual studio. The net platform development consists of six modules: (1) User management module. Server application software and intelligent sensor network user and administrator authority division and authentication. (2) Data Management Module. Responsible for storage, inquiry and analysis of greenhouse environmental information, spatial information and decision-making information, and can print reports. (3) Real-time information monitoring module. Real-time data, live video of greenhouse scenes, node topology information, and sensor network operating status information can be displayed in the form of curves and data. (4) Intelligent Decision Module. Greenhouse management decisions based on real-time data and expert systems. (5 alarm display module. It can set the threshold for each monitoring information. When the real-time information exceeds the threshold, the server application software can voice promptly the management personnel and send the alarm information to the designated user in the form of a short message. (6) Control module. Send remote commands to collect sensor information of a specific sensor node in a single or periodical manner, and remotely control server application software and each node of the sensor network through SMS, and control actuators such as the PLC drive fan and the wet screen [3].

According to project requirements analysis, in order to facilitate remote access management for customers, the system needs to set a login interface, perform authentication, and divide users' rights. Different users are given different rights such as data browsing, query, modification, parameter setting, and organization control. . The user management module can perform new user registration and rights management after the old user logs in. By setting the login interface, the user is authenticated, the corresponding operation permission is obtained, and the user database is established. The system administrator has the highest authority to manage all the functional modules of the system and has the power to set non-administrator rights. The general guest can only browse the system, query the information of the environmental factors of the current greenhouse and the real-time video of the greenhouse, and cannot set the system and control the executing agency. The user management interface first reads the user name and password from the login interface, uses form authentication to prevent unauthorized users from intruding, and makes a query in the user table User. If the user exists and the password is correct, the user enters the main interface if the user does not exist. , you are prompted to enter the registration interface.

The digital-analog management module manages the collected greenhouse historical data, saves the collected data in a database, and provides users with queries, downloads, and prints. Greenhouse data is displayed in the form of curves and tables. The curve displays the historical data plotted on the interface through the control. The table display shows the time of each acquisition node, the node number, the number of the greenhouse where the node is located, and the measured value. Through the analysis and processing of historical data in the database, the greenhouse climate changes are visually analyzed, and the crop microenvironment is better adjusted by combining the growth of greenhouse crops [4].

The real-time information monitoring module allows the user to view the current environmental information of the greenhouse anytime anywhere, including real-time data, real-time video, sensor node topology information and virtual greenhouses, and displays the real-time data of each collection node in a curve or data manner. The Virtual Greenhouse constructs a virtual map of the actual greenhouse through the functions provided by the Visual Graph platform and the original basic graphics, simulates the operation of equipment (wind fans, wet curtains, sunroofs, etc.) in the actual greenhouse, and synchronizes the virtual greenhouse with the actual greenhouse. The real-time information monitoring module uses Flash animations to design buttons such as temperature, humidity, CO2 concentration, and light intensity. When the mouse is pressed, the Fluorine Gateway invokes the GetRealtimeData method of the GetSqlData class in Net to obtain the current value and display it in the Flash animation button. Environmental parameter values and time.

The intelligent decision module mainly controls the growing conditions of crops, and sets the greenhouse environmental parameters such as temperature, humidity, light, and CO2 concentration to reach the appropriate range, and performs automatic and intelligent control of greenhouse crops. The real-time parameters were collected and compared with the set values, and the intelligent growth decision system was used to regulate the crop growth environment to achieve an ideal growth state. The intelligent decision algorithm runs in Internet applications and intelligent decision control is achieved through the Socket communication between the control module and the central control software. The control module includes two functions: remote manual control and automatic control. It requires a certain amount of authority to operate [5]. Manual control Click the button on the interface to perform the corresponding mechanism switch operation. The button is made with Flash. When the mechanism is in the stop state, the Flash icon is a gray static icon. When the mechanism is running, the Flash icon is a color dynamic icon. The actuators used in this system mainly include fans, sunroofs, wet curtains, screens, automatic sprinkler irrigation systems, and fill lights. Through the action of the actuators, the temperature, humidity, CO2, and light intensity of greenhouses in modern agricultural halls are regulated. Automatic control compares current environmental parameters (including temperature, humidity, and light intensity) with appropriate environmental parameters of crops, and combines the rules table generated by fuzzy control theory to determine the purpose of automatic control of the implementing agency.

4. Intelligent Greenhouse Control System Hardware Design

The hardware of the intelligent room control system is mainly composed of five parts: the computer (the upper computer), the intelligent processing system, the intelligent acquisition system, the implementing agency system and the communication system. In this system, the PC as a host computer can accept the signal transmitted from the lower computer system, and can also modify the parameter values. The lower computer adopts Cygnal's C8051F040 microcontroller, which expands the data acquisition sub-module and real-time clock. Submodules and subordinate computer communication submodules, etc. The main functions of each section are as follows. 1 Based on various information collected by the intelligent collector in real time, the computer processes and calculates in a timely manner according to the set fuzzy neural control algorithm, makes a decision, issues a control instruction, and performs control through the executing mechanism. 2 The intelligent processor in the intelligent processing system is the core of the whole system. It collects data information and detects the operating status of the system from the intelligent collector and PLC through the bus, and performs fuzzy neuron analysis and calculation according to the set parameters. The result of the operation is controlled by the PLC through the device so that the entire system operates according to the set mode to achieve the best control effect. 3 Intelligent collection systems include intelligent collectors, temperature sensors, humidity sensors and illuminance sensors, among which the intelligent collector is the core of the collection system. It uses various high-performance sensors to measure the external climate and temperature and humidity in the greenhouse. , light and other real-time data acquisition, and the measurement results sent to the intelligent processor through the bus. 4 The actuator system includes skylights, side

windows, roller blinds, wet curtains, fans, sunshade nets, and sprays. All the execution equipment of the system is controlled by the PLC output, and most of the control devices are motors. 5 The communication system uses the form of a communication bus for data communication and sends control commands. This system contains three bus types 232, 485 and CAN.

5. Conclusion

The system has been operating in a modern agricultural hall in Jiangsu Agricultural Expo Park for more than two years. Since the system has been operating stably and reliably, it has achieved all-weather automatic collection of greenhouse temperature data such as temperature, humidity, light, soil moisture, and CO2 concentration. With intelligent control and remote network monitoring through Internet network terminals, the intelligentization level of greenhouse systems has been improved, labor management costs have been reduced, and greenhouse management efficiency has been improved. Operational effects have reached design expectations. The intelligent greenhouse management system has also been promoted and applied in surrounding agricultural science and technology demonstration parks and agricultural enterprises, and has achieved good results.

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