Design of Greenhouse Control System for Wireless Sensor Network

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Abstract: Agriculture is an important pillar industry in the country. Good climate and ecological and environmental conditions are important guarantees for agricultural production. The suitable temperature for the growth of most plants is between 12 ℃and 33℃.However, due to the lack of land, poor soil quality, and lack of soil resources in some provinces, these disadvantages are detrimental to the growth of crops. At the same time, changes in CO_2, light, and water also directly affect the growth and development of plants. This paper combines PC, mobile phone, 4G network and sensor to make use of their respective advantages and greatly improve the management level of agricultural production automation. The intelligent monitoring system of greenhouse environment designed in this paper accords with the basic national conditions and has high cost performance. It is of great practical significance for changing the way of agricultural economic growth and realizing the sustainable development of agriculture.

1. Introduction

The greenhouse control system mainly goes through the following five stages of development: manual control, mechanical control, decentralized electric control, centralized electronic control, and computer integrated control. The environmental factors required for plant growth are relatively complex, traditional control methods. It is difficult to regulate and control the interaction of environmental factors (including temperature, water temperature, soil temperature, CO_2 concentration, etc.) in a timely manner. However, since the 1980s, computer-controlled greenhouses have gradually become mainstream due to the rapid development of computer technology and the drastic reduction in prices.

2. System profile

The system adopts distributed control, centralized management, and uses computer network technology, automatic control technology and communication technology to achieve the following goals:

(1) It can work continuously and steadily for a long time;

(2) It can accurately measure the high temperature and humidity, soil temperature and humidity, illumination, CO_2 concentration, and leaf surface temperature in the greenhouse;

(3) The controller part can choose two settings in local/remote locations. In the local state, the operator can manually set the upper and lower limits of the environmental parameters in the greenhouse, and can automatically control the execution mechanism according to the set parameters, which can work alone and have the active data uploading function.

(4) It is possible to control the scene in real time through the mobile phone client, and at the same time record the environmental information in the greenhouse and the action records of the execution mechanism. Even if there is no staff on the scene, it can be fully automatic to control the equipment in the greenhouse

3. System design scheme

3.1 Bottom controller design

The bottom controller is based on ARMLPC1769 chips, Keil4 development environment, and C language programming. The functions of the modules in each section are as follows:

(1) Data processing module: The data processing of various sensors in the collection room is uploaded after data processing.

(2) Data display module: LCD can be divided into pages to display the current environment parameters, and can be used to query the execution of the organization action record.

(3) Alarm module: When the parameter exceeds the set value, an alarm tone is issued and the alarm information is uploaded through the data module.

(4) Communication module: GPRS communication is used to connect to the server via DTU.

(5) Executing organization: including drainage system, heating system, irrigation system, drawing system and seedling bed movement. Among them, the exhaust system uses relays to control the positive reversal of the deceleration motor, which can open and close the top window and the side window, and can carry out natural ventilation in the greenhouse. The heating system can use a hot water heating system to control the power switch of the pump through the relay.In the low temperature season, the irrigation system adopts drip irrigation, and in the high temperature dry season, microspray irrigation is used to control the switch of the irrigation system through relays.

The pull screen system can adjust the illumination, cooling or insulation, and realize the positive reverse of the decelerating motor by relay control. The seedling bed system can increase the utilization area of the greenhouse and realize the lifting and lifting of the seedling bed through the relay control motor.

3.2 Server-side design

This section uses JDK 1.4.2, MyEclipse, Mysql 5.1, Tomcat 6.0 to develop environments and tools and is divided into the following six modules:

(1) Administrator Management: Set the scope of operation according to permissions.

(2) Information management: real-time display of environmental parameters in the greenhouse.

(3) Equipment management: Control indoor equipment, and can query, increase, delete, modify equipment information.

(4) Database management: Historical data and executing agency actions record queries and generate data reports.

(5) Video monitoring: real-time video server video monitoring.

(6) System settings: Enter the controller's address, video server address.

3.3 Android client design

This section uses Eclipse to integrate Android SDK and Adt development and is divided into the following five modules:

(1) User management: Login verification, enter account number, password.

(2) System settings: password modification, server address modification, mobile phone number modification and other parameters.

(3) Remote control: Control the operating mechanism of the greenhouse through a mobile phone.

(4) Automatic alarm: When the parameter exceeds the set value, the mobile phone receives the alarm information and automatically saves it.

(5) Video monitoring: real-time video server video monitoring.

4. System framework

The system adopts upper and lower machine control scheme. The lower controller is the front-end controller of the system, including circuits such as data acquisition, data display, alarm module, communication module, and actuator. The lower machine is a background monitoring

system for mobile phones, which mainly consists of server and mobile phone client monitoring software.

4.1 Overall framework

The overall scheme of the greenhouse control system is shown in Fig. 1.

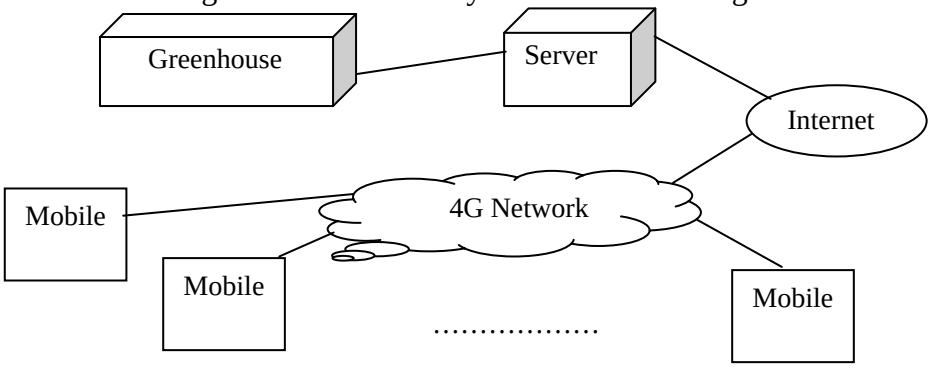

Fig. 1 General framework of the greenhouse control system

4.2 Design flow of host server

The design flow chart of the host server is shown in Fig. 2.

4.3 Design flow of Client

The design process for the client is shown in Fig. 3.

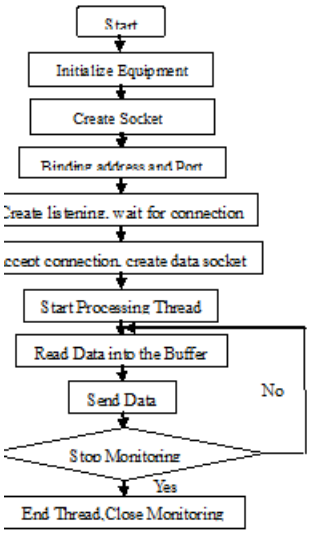

Fig. 2 Server-side flowchart

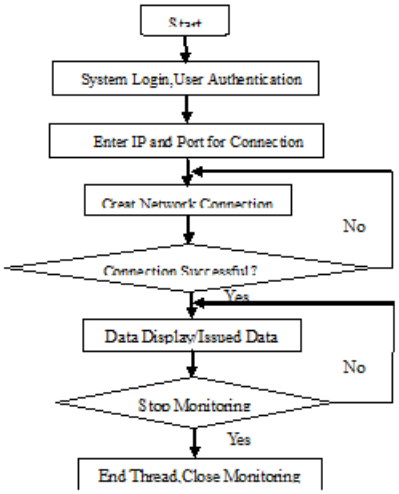

Fig. 3 Client flowchart

4.4 Design flow of Lower Controller

The technical route used for the lower controller is shown in Fig. 4.

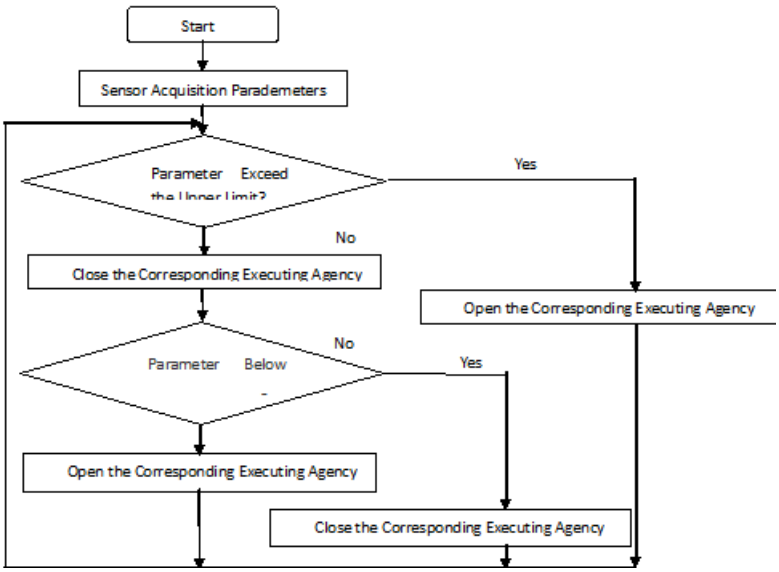

Fig. 4 Lower controller flowchart

5. Summry

This project has been successfully applied in greenhouses. According to the requirements for the growth of greenhouse plants, automatic control has been achieved for window opening, roll film, fan wet curtain, bio-lighting, irrigation and fertilization, etc., and the temperature room environment has been automatically controlled and reached the range suiTable for plant growth. It provides the best environment for plant growth.

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