Research on the Decision Optimization Model of Greenhouse Soil Information Collection System

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Abstract. With the advent of the information age, the rapid development of information technology has changed the lives of human beings. The application of this technology in agriculture has changed the traditional production methods for thousands of years and opened a new page in agricultural development. This paper briefly introduces the greenhouse soil information collection system, expounds the design of the optimization decision model, and further optimizes the greenhouse soil information collection system.

Introduction

The greenhouse soil information intelligent collection system mainly consists of two parts: the greenhouse soil information collection terminal and the upper computer information management platform. The system can quickly obtain information such as the geographical location, humidity, and temperature of the greenhouse soil. The collected data is saved in the database to provide basic data for subsequent analysis of soil composition content and spatial distribution map of soil composition, so that the greenhouse fertilizer management can be better guided. Intelligent human-computer interaction interface and networked remote management and maintenance are the development trends of various equipment management and maintenance. At the same time, the development of information technology and network technology has provided a mature platform for this. The information collection system for greenhouse soils usually works in a wide-ranging, complex environment greenhouse environment. The collection of greenhouse soil information is often a continuous collection of multiple locations, which requires the system to have strong real-time, accuracy and simple operational characteristics. For the optimization decision model, based on the existing research, the RTU-1600 programmable measurement and control module is used, and the embedded monitoring system program is developed by using dynamic C language. The distributed remote data acquisition system based on GPRS and WEB is realized. Compared with the original system, the system's integration, mobility, and cost performance are further improved.

Greenhouse Soil Information Collection System

Soil information content.

The content of soil information is mainly composed of its chemical composition, fertility characteristics, pH, moisture, salinity, texture and exchange characteristics. In the case of the same soil texture, the physical, chemical and biological properties of the soil are not exactly equal in the spatial position of each location at the same time, and even there are relatively large differences; On the other hand, soil properties at the same spatial location also exhibit different values at different times. This difference is called the spatiotemporal variability of soil properties. According to spatiotemporal variability, the above information can be divided into two categories. One kind of soil information content such as soil structure type, terrain slope, dish, potassium and organic matter content, value and other relatively stable spatial and temporal variability is the necessary information collection content. Some of these data, such as soil trace elements and soil types, allow reference to previous soil census data as a reference. Phosphorus, potassium, organic matter content and tillage depth need to be as small as possible using standard grid-type sampling to obtain soil for instrumental analysis at the Institute. This puts higher requirements on the accuracy of the

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collection location of soil samples; As the nitrogen content with large spatial and temporal variability and soil moisture, the difference in soil information is different in different spaces at different times. This puts higher demands on the sampling device and requires instruments that can acquire and accurately process data in real time. Among them, the functional schematic diagram of the designed greenhouse soil information intelligent acquisition system is shown in Figure 1.

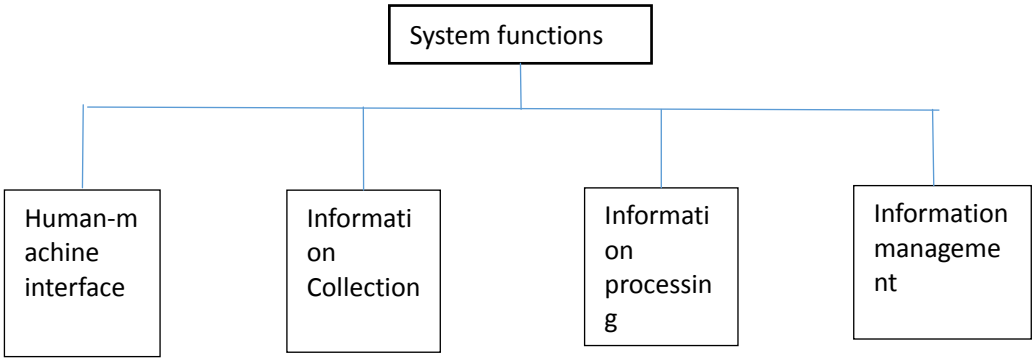

Figure. 1 Functional Diagram of Greenhouse Soil Information Intelligent Acquisition System

Soil information collection method.

At present, there are many methods for collecting soil information in China. However, it is mainly based on the technology of the 1950s and 1960s, taking soil samples through manual samplers, then performing laboratory analysis and then entering data. Such an operation process is not only costly but also inefficient. Moreover, due to the inaccurate measurement of the spatial scale of the soil sampling points, it is difficult to draw an accurate spatial distribution map of the parameters of the soil.

Greenhouse soil information research.

In precision agriculture, the most important problem to be solved is the core issue of access and research of greenhouse soil information. It is to obtain agricultural information in a fast and real-time manner, and then to conduct research and visualize the information in an information-based way, so as to provide decision-making basis for fine fertilization and fine irrigation. The technical conditions that enable the successful development of greenhouse information research include greenhouse information collection system, global positioning system, geographic information system, management decision system and intelligent agricultural machinery. The soil sampling equipment is the most basic soil research machine, and its intelligence directly affects the quality and efficiency of greenhouse information research. Therefore, only a new type of soil sampling equipment with higher intelligence and intelligence can be better served for precision agriculture.

Design Principle of Soil Information Collection System

Basic principles for hardware design.

Hardware should meet the functional requirements of the intended design. After the hardware circuit design is completed, it must be able to run stably and realize the expected function. This is the primary condition; the cost is reasonable. Under the premise of meeting the design requirements, the hardware design should reduce the economic cost as much as possible and stress the cost performance. On the basis of reliability, speed, storage capacity, and compatibility, it is necessary to reasonably select micro-controls and peripherals instead of blindly seeking the most advanced and latest microprocessors and peripherals; safe and stable. When selecting electronic devices, the temperature, humidity, air pressure, vibration intensity, etc. of the working environment should be fully considered to ensure that the system can operate stably and reliably under normal working conditions. At the same time, it is necessary to have over-range and overload protection to prevent the electronic circuit from being burnt out due to excessive voltage and current, so as to ensure that

the system can work safely; Power consumption issues. It is necessary to understand the maximum power consumption of each device, to ensure the power consumption requirements in the power supply design, to avoid the power supply cannot drive the circuit after the hardware circuit is designed, and to have sufficient anti-interference ability.

Basic principles for Software design.

The structure is reasonable. After the programming is completed, the subsequent expansion, modification, and maintenance of the program must be considered. Therefore, the program should adopt a structured module design. When writing programs, it is necessary to maximize the use of subroutines by making them hierarchical, easy to read, and understand. At the same time, it is also necessary to minimize the program's memory footprint and simplify the program as much as possible. For frequently changing parameters, try to use macro definition or design independent parameter transfer program, which is convenient for program modification and improves program operation efficiency; Real-time. Real-time requirements are a basic requirement for most embedded systems. In the case of high real-time requirements, try not to let a module or function take a long time, and use the real-time operating system as much as possible; portability. The development speed is very fast, and the higher performance and lower price chips come out every year. Therefore, when designing the code, it is necessary to fully consider the portability of the program, carry out multi-level software design, and separate the hardware-related parts and the algorithm structure part; High efficiency. There is a need to avoid using floating point to participate in the operation. Using floating point operations is not only time consuming but also time consuming.

Decision Optimization Model Design

Design and realization of on-site monitoring system.

The monitoring module uses the RTU-1600 measurement and control terminal produced by Beijing Weikong Company. The product is based on Rabbit series single-chip microcomputer, integrates GPRS wireless communication function, collects greenhouse field data at regular intervals, and sends the data to the database server through GPRS network and Internet. The digital sensor is developed by the Institute of Agricultural Environment and Sustainable Development of the Chinese Academy of Agricultural Sciences. It can also select sensors from any other manufacturer according to user needs. The RS-485 bus is a half-duplex communication standard that uses a pair of balanced differential signal lines. Due to the balanced differential signal transmission, the anti-interference ability of the signal during transmission is greatly enhanced compared to RS-232, and the transmission distance can reach 1200m.

Database server design.

The system database server is separated from the WEB application server, which is beneficial to data security and upgrade and maintenance of the WEB application server. The database uses MS SQL Server2000 to provide easy maintenance and stable support for the system. In order to receive and process the greenhouse environment data sent over the mobile GPRS network, a data management software must be developed for the database server. Network data transmission and management software system application VB.NET and ADO.NET technology development, VB.NET belongs to Visual Studio.NET series. It is a powerful, efficient and scalable programming environment that provides great convenience for software design. ADO.NET is a new data access technology under the .NET framework. ADO.NET can be used to facilitate database access. The function of the software is to listen to the user-specified port after startup, and if there is a remote IP request to establish a TCP connection, accept the request and establish a connection.

WEB application server design.

The WEB application server uses MS-IIS (Microsoft Internet Information Server) technology, and the network publishing module implements the B/S (brower / server) architecture using ASP.NET technology. The user operation is implemented by a browser (brower), the main service is implemented on the server side, and the data storage and extraction are implemented on the database server side to form a three-tier structure. Users can view remote data information through web browsing (Figure 4), and data that is unintentionally exposed can be restricted by granting

different levels of access.

Conclusion

The greenhouse soil has the characteristics of wide area, scattered, complex environment, far away from the regional center, and weak communication infrastructure. This requires that the greenhouse soil information intelligent collection system should have strong environmental adaptability, real-time, and accuracy, and should also have flexible tailoring and expansion capabilities to meet the actual requirements for greenhouse soil information collection under different conditions. The underlying network of the system supports receiving data sent by multiple soil collection terminals, which facilitates flexible adjustment of greenhouse soil information collection scale and collection range.

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