

Design of Agricultural Monitoring System Based on Internet of Things

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Abstract: Farmland is an inexorable natural resource, and how to improve the production efficiency, economic benefit and environmental benefit of farmland by means of advanced scientific and technological means on the basis of limited farmland resources has become a major issue that must be solved in China, and the integration of information technology and agricultural technology provides a way to solve the above problems.

Keywords: Internet of Things; Agriculture; Monitoring system.

1. INTRODUCTION

In the past, farmers often managed greenhouses by experience, which easily affected the timeliness and scientificity of crop management in greenhouses. At present, the Internet of Things farmland monitoring systems proposed by the integration of information technology and agricultural technology at home and abroad usually collect environmental data from multiple locations in farmland and then transmit them to the monitoring center for monitoring, so as to achieve efficient monitoring and management of large-scale farmland. However, the existing systems are often large in size, high in cost, high in power consumption and complex in equipment, which are only suitable for large-scale farmland and difficult to popularize. Therefore, it is necessary to provide an Internet of Things farmland monitoring system with simple structure, low cost and high monitoring efficiency.

2. PROJECT CONTENT

This project provides an agricultural monitoring system based on Internet of Things, which is used to solve the technical problems of large size, high cost, high power consumption and complex equipment of the existing farmland monitoring system proposed in the above background technology.

The basic characteristics of the Internet of Things From the perspective of communication objects and processes, the information interaction between things and people and things is the core of the Internet of Things. The basic characteristics of the Internet of Things can be summarized as overall perception, reliable transmission and intelligent processing.

Overall perception—you can use RFID, two-dimensional code, smart sensors and other sensing devices to sense and obtain all kinds of information of objects.

Reliable transmission—Through the integration of Internet and wireless network, the information of objects can be transmitted in real time and accurately for information exchange and sharing.

When talking about the Internet of Things, we have to mention the Radio Frequency Identification (RFID), which has attracted much attention in the development of the Internet of Things. RFID is a simple wireless system consisting of an interrogator (or reader) and many transponders (or tags). Tags are composed of coupling elements and chips, each tag has a unique electronic code of extended entry, which is attached to an object to identify a target object. It transmits radio frequency information to a reader through an antenna, and a reader is a device for reading information. RFID technology enables objects to "speak". This gives the Internet of Things a feature, namely traceability. That is to say, people can grasp the exact location of objects and their surrounding environment at any time. According to the retail analyst of Sanford C. Bernstein Company, this feature brought by RFID in the Internet of Things can save Wal-Mart 8.35 billion dollars every year, most of which is due to the labor cost saved because it does not need to manually check the incoming barcode. RFID has helped the retail industry to solve the two problems of goods out of stock and loss (products lost due to theft and supply chain disruption). Now, with theft alone, Wal-Mart has lost nearly 2 billion dollars a year. Intelligent processing—Using various intelligent technologies, analyze and process the sensed and transmitted data and information, and realize intelligent monitoring and control. According to the above characteristics of the Internet of Things, combined with the viewpoint of information science, around the flow process of information, we can sum up the functions of the Internet of Things in processing information:

(1) The function of obtaining information. It is mainly the perception and recognition of information, and the perception of information refers to the perception and sensitivity to the state of things' attributes and their changing ways; The recognition of information means that the state of things you feel can be expressed in a certain way. (2) The function of transmitting information. It is mainly a task of sending, transmitting and receiving information, and finally transferring the acquired state information and its change mode from one point in time (or space) to another, which is often called communication process. (3) The function of processing information. It refers to the process of information processing, using existing information or perceived information to generate new information, which is actually the process of making decisions. (4) Function of effect information. It refers to the process of information finally exerting its utility, which has many forms of expression. It is more important to keep the object in a pre-designed state by adjusting the state of the object and its transformation mode.

technical proposal

In order to achieve the above purpose, the technical scheme provided by this project is as follows: the agricultural monitoring system based on the Internet of Things includes a greenhouse body, which is provided with an environmental monitoring module, a pest control module, a photographing module, a power supply module, a main control module, a relay module, an illumination supplement module, a temperature and humidity supplement module, a communication module and a terminal;

Hardware data acquisition and control system is mainly composed of power supply system, MCU control system and sensor equipment. Power supply system: The hardware main control system supplies power through USB serial port circuit, and the output voltage is 5V. Scm control system: this module adopts STM32F104 enhanced chip, which has the characteristics of high performance, low cost and low power consumption. it can be compatible with 5V I/O pins, has up to 112 fast I/O

ports and up to 11 timers. it is widely used in various embedded systems and is very suitable for controlling sensors to collect data. In the whole hardware system, instructions can be received, executed and sent, and data transmission can be carried out according to the preset program. Equipment: according to the environmental characteristics of agricultural system, the main sensor collection equipment includes soil humidity sensor, atmospheric temperature and humidity sensor, CO₂ concentration sensor, light intensity sensor, etc. In addition, it also includes buzzer equipment in alarm module and camera equipment in monitoring module. The realization of control system is based on UART serial communication protocol of embedded system, and data can be sent and received by configuring wireless communication protocol. The communication between the upper computer and the lower computer can be realized by using serial port, and the upper computer can send various instructions to control the sensor and alarm module to operate accordingly by writing programs; The software terminal is mainly used to send control instructions, and then the control system carries out intelligent processing to realize the monitoring of environmental data and the on-off operation of equipment.

The environmental monitoring module is used for detecting the temperature, humidity and gas changes in the greenhouse body and transmitting the detected information to the main control module; The pest control module uses a plurality of pest monitoring and reporting lamps to control pests; The camera module takes pictures regularly by using the camera and sends the pictures to the main control module.

The main control module uses single chip microcomputer, and the relay module is used to amplify the control circuit.

The illumination supplement module is controlled by the main control module to supplement light in the shed when the light intensity is insufficient;

The temperature and humidity supplement module is controlled by the main control module.

The communication module sends the monitoring information transmitted to the main control module to the terminal.

The greenhouse body is hinged with a plurality of roofs which are adsorbed by electromagnets, and the roofs are fixedly connected with a rotating rod, one end of which is fixedly connected with a motor; an electrically retractable sunshade curtain is arranged on the roof; a ventilation curtain capable of being electrically rolled up is arranged on one side of the roof; and a plurality of pressure sensors are arranged on the roof, and the pressure sensors feed the detected information back to the main control module.

The environment detection module is placed in the greenhouse body, and comprises a plurality of temperature and humidity sensors, a plurality of light intensity sensors and a gas analyzer, and the temperature and humidity sensors, the light intensity sensors and the gas analyzer send the acquired greenhouse environment information to the main control module.

The illumination supplement module comprises a plurality of plant fill lamps, the height of which is 1.5 meters away from the growing point, and the plurality of plant fill lamps are hung in multiple rows, and the plurality of plant fill lamps are electrically connected with the main control module.

The temperature and humidity supplement module comprises a plurality of ground rail heating pipes and a plurality of water mist nozzles, wherein the ground rail heating pipes are uniformly laid in the

greenhouse body; the water mist nozzles are connected with a water source; spraying control is carried out by using an electromagnetic valve; and the ground rail heating pipes and the electromagnetic valve are electrically connected with the main control module.

Second, the research advantages of the Internet of Things

Compared with the prior art, the technical scheme provided by this project has the following beneficial effects:

The structural design of this project is reasonable. The environmental detection module is used to monitor the changes of temperature, humidity and gas in the shed, and the microcontroller and relay are used to control the light supply, humidification, temperature increase and ventilation in the shed automatically, and the data can be detected to send out alarm signals. The equipment is simple and the cost is low. Furthermore, the roof is designed to be rotatable, so that the pressure on the roof reaches a preset value in snowstorm weather, and the roof can be unscrewed, thus prolonging the service life of the roof.

The technology of Internet of Things is applied in intelligent agricultural system, and its technical principle is: intelligent sensor equipment and integrated intelligent control system are installed in agricultural greenhouses or crop growing areas, through which the agricultural environment can be connected with the network according to the agreed agreement. Based on the development of Wi-Fi technology, RFID technology and sensor network technology, the data collected by sensors are analyzed, and the growing environment of crops is intelligently controlled to achieve the most suitable conditions for crop growth. Wi-Fi technology can connect various sensing devices to local area network to realize wireless network transmission; In the whole system, RFID technology analyzes and processes the received frequency signals, and then transmits them to the background and cloud to control the data information. Sensor network is the core technology of Internet of Things, which is mainly used for information exchange and transmission, and has the function of data storage.

3. CONCLUSION

Based on the Internet of Things technology, the intelligent agricultural management system designed in this paper adopts the combination of software and hardware, builds a hardware control platform through embedded system technology, and realizes the interconnection of all things by using the Internet of Things technology, which is convenient for environmental monitoring and intelligent management. It can also intelligently manage and control the agricultural environment on the software operating system, adjust the current uncomfortable environmental conditions in time, and provide the best guarantee for crop growth. It not only reduces the workload and operational difficulty of agricultural managers, but also has a wide range of applications in improving crop growth environment and crop production efficiency.

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