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Design of Remote Monitoring System for Intelligent Agricultural Feeder Based on Internet of Things Technology

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Abstract

The technology in the design of the intelligent agricultural feeder remote monitoring system based on the Internet of Things technology effectively solves the problem of remote monitoring through the use of interface attenuators, improves the efficiency of agricultural feeders, and can greatly meet the sustainable development. The successful development of the remote monitoring system design for intelligent agricultural feeders based on the Internet of Things technology can successfully monitor agricultural feedstock with high precision, including data monitoring and collection to achieve intelligent effects.

Keywords: *Intelligent Agricultural Feeder, Internet of Things Technology, Remote Monitoring, Replay Missed Seeding, Planter;*

1. Introduction

The intelligent agricultural feeder of the Internet of Things technology promotes the informatization of agricultural feed[1-2]. Through the use of various wireless devices, various information during agricultural feeding can be presented to the eyes through the intelligent automatic monitoring and transmission function of the Internet of Things technology, realizing the rapid connection between the background control and the agricultural feeding site. At the same time, through the remote monitoring system software and hardware and mobile phone/computer client, it can monitor natural disasters in real time and early warning in time, and manage the growth of agricultural crops more appreciably, and achieve the automatic sharing of information and agricultural feeding[3-4]. The remote monitoring system of intelligent agricultural feeder based on Internet of Things technology can improve the management of agricultural feeder site. In the production process of intelligent agricultural feeding, the wireless smart sensor of the Internet of Things realizes the real-time collection and real-time transmission of various data such as the working environment of intelligent agricultural feeding, providing a favorable scientific basis for crop feeding and greenhouse control[5-6]. Intelligent agricultural feeding of the Internet of Things not only provides good conditions for agricultural feeding, but also improves the efficiency of feeding.

2. Seeding quality monitoring technology and its application in feeder monitoring system

During the operation of the feeder, if the feed is incorrect, in addition to causing material waste, some components containing pollutants will also pollute the environment, so real-time monitoring is required during the operation. During the operation,

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the seeding quality of the seeder is mainly affected by the seeder. If the quality of the seeder is not high, it will cause quality problems such as missed and replayed. Therefore, real-time monitoring of the seeder is required. The feeding of the feeder is similar to the working principle of the seed meter of the planter, and these two quality monitoring systems can learn from each other. Take the design of the planter monitoring system as an example, the overall design framework is shown in Figure 1.

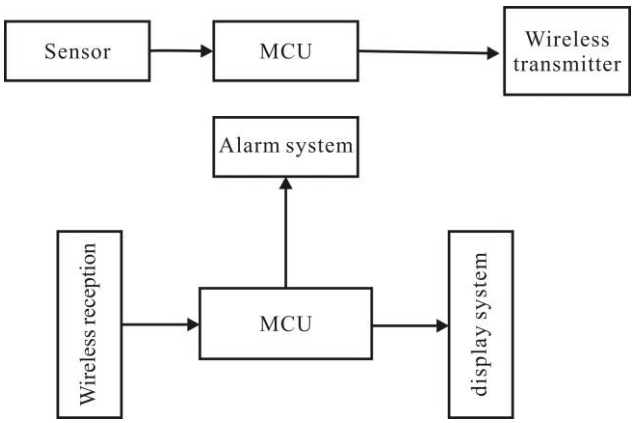

Figure 1. The overall design framework of the remote monitoring system.

The remote monitoring system uses single-chip microcomputer or PLC as the main control chip. Sensors can be used to collect information on the remote working end of the planter or feeder. The collected information is processed by a single-chip or other controller and then used by mobile communication or wireless transmission devices. Transmit the signal; at the remote monitoring end, after receiving the information data through the wireless receiving module, through data processing and analysis, the real-time data is visually displayed. If the monitoring data reaches the alarm threshold, a danger alarm will be issued.

3. Internet of Things and Smart Agriculture

As an extended field of Internet technology, the Internet of Things is more personalized and privatized than Internet technology. In essence, the interconnection of the Internet of Things is mainly the interconnection between things and people, which can be basically divided into three types: things and things, things and people, and people and people.

3.1. RFID technology and smart agriculture

The Internet of Things is a product of the progress of the times, and is essentially the integration of a variety of advanced technologies. It will continue to develop with technological innovation. In the intelligent agricultural monitoring system, object recognition technology is a more important technology. Many functions of the monitoring system need to rely on this technology to achieve. In the object recognition technology, RFID is a representative one.

RFID technology, also known as electronic tag identification. It can specifically reflect all the identifiable information of the marked target, and the feedback information is unique. The first step to realize the intelligent agricultural monitoring system is to assign unique tags to all the intelligent devices in the home, such as access control, monitoring, storage, etc., so as to realize the interaction between humans and intelligent agriculture, and all these mainly rely on RFID technology.

3.2. Intelligent agricultural monitoring system

The monitoring and control of smart agriculture mainly relies on the Internet and mobile communications. The first step of the design is to enable the monitoring system to accurately identify various functions in the subsystem. The system design needs to meet the requirements of effective, reliable, easy to maintain, easy to repeat operation, simple to use, safe to operate, and not picky about the environment. System design should take into account system operation, data management, and auxiliary personnel to complete monitoring instructions.

1) Monitoring of seeding and feeding amount. When the planter is working normally, the seed metering device discharges the seeds, and when it encounters the light beam from the infrared sensor, it

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will produce an obstructive signal and generate a high-level signal; when no seeds are discharged, the level signal is a low-level signal. In the same principle, in the feeding process, high and low level signals can also be used to judge whether there is material input, and to count the amount of material input.

2) Replay missed broadcast and material delivery accuracy monitoring. Both replay and missed seeding can be calculated by the time interval between two sowings. When replay occurs, the time between two seedings will be very small. When there is a missed seeding phenomenon, the interval between two seedings should be greater than the time of one seeding. In the same way, the accuracy of material feeding can also be monitored. First, measure the two time intervals of normal feeding, and then use sensors to measure the time interval during feeding operations to judge whether the feeding is accurate.

3) Monitoring of seeding speed and feeding efficiency. The seeding speed can be equivalently calculated by the metering speed of the seed meter, and the material delivery speed can also be calculated according to the material feeding time. Through the monitoring of the seeding speed and feeding efficiency, the operating quality of the seeder and the feeder can be understood.

4. Design of remote monitoring system based on internet of things technology

Based on the Internet of Things technology, remote monitoring of various items can be realized, such as the temperature and humidity of the environment, the real-time operation of the machine and the quality of the machine. The planter mainly monitors its replay rate and missed rate during operation. The key monitoring item is the operation status of the seeding tray; the intelligent agricultural feeder mainly monitors the accuracy of feeding, and also needs a monitor to monitor the environment. Degree of pollution. Take the measurement of environmental humidity as an example, the circuit is shown in Figure 2.

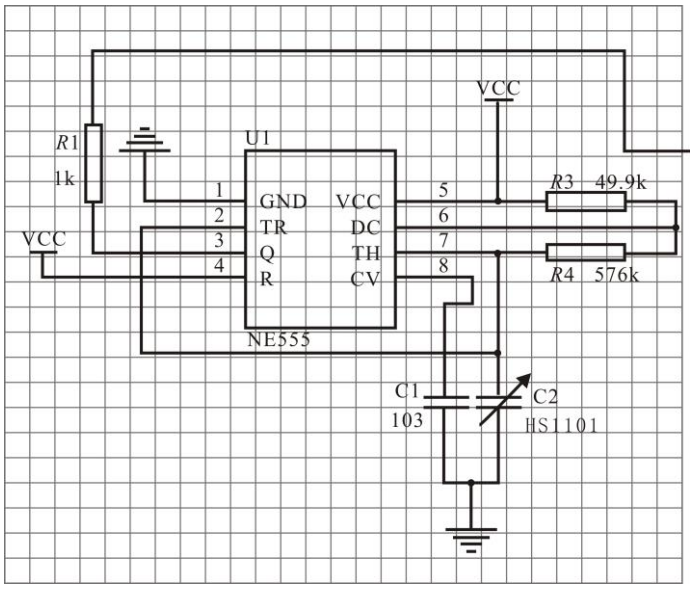

Figure 2. Principle of environmental humidity measurement.

The HS1101 capacitive humidity sensor is used for environmental humidity monitoring. The capacitance cannot be directly measured during the measurement process. It is necessary to use a multi-resonance circuit to monitor the frequency of the circuit, and then use the control center to read the value of the capacitance, and calculate the phase according to the capacitance value. The corresponding humidity value can be used to accurately measure the environmental humidity during the operation of the feeder. After the measurement is completed, the value needs to be displayed. The principle of the display circuit is shown in Figure 3.

The display module is an important part of the remote monitoring of the Internet of Things. For the value of the environmental humidity, the 1602 liquid crystal display and its matching controller and driver components can be used to complete.

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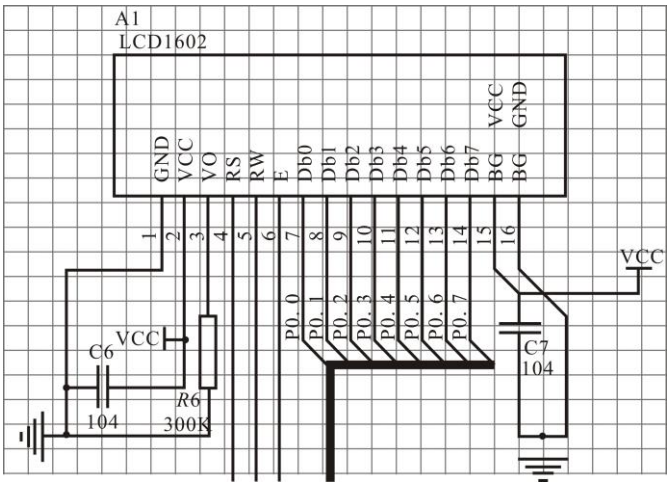

Figure 3. Shows the circuit schematic.

After the hardware circuit design of the environmental humidity monitoring of the feeder is completed, the software part needs to be designed. When the humidity is displayed, the timing display method is adopted, and the corresponding alarm will be issued when the timing display cannot be performed.

When monitoring the seed metering device of the planter or monitoring the feeding quality, the sensor used on the site transmits the obtained analog signal to the remote monitoring personnel through the Internet of Things communication; the remote controller obtains the operating status information of the machine through the controller and the display, and then The control instructions are transmitted to the on-site operators through the Internet of Things communication technology; the on-site operators use the on-site controller to operate the equipment, so that the planter or the only feeding equipment has higher accuracy.

The module includes a control circuit that controls the switch circuit, sensor circuit and DC servo drive motor. In the process of realizing remote automation control, remote management personnel use GSM SMS to send control instructions. After receiving the instruction information, the PLC controller center first interprets the instructions, and then executes the corresponding actions to realize the seed metering device or intelligent agricultural feeding Remote control of machinery.

5. Design of remote monitoring of intelligent agricultural feeder

5.1. Briefly describe system functions

This monitoring system mainly combines the main application smart phone, a certain network open platform and the wireless data transmission part based on ZigBee. Through the connection of the three, users can realize the control of the smart agriculture of the residence through the mobile phone. In addition, this system also meets the needs of data query and monitoring work, and meets the needs of users for more intelligent and faster life services. The intelligent agricultural monitoring system can rely on the computer to create an effective platform, so that the gateway can receive and transmit relevant data information in a more timely manner. And it can realize the rapid processing of data and complete control of the monitoring situation through ZigBee.

5.2. ZigBee internal design

In the intelligent agricultural system, different ZigBee nodes need to be effectively controlled. But the difference of the node directly leads to the difference of its gateway restriction. Therefore, when constructing the system, a tree topology is used for the convenience of networking. The topological structure of zigbee can be divided into three types typically, star, tree and mesh, as shown in Figure 4. The biggest feature of the star topology network is that the communication between any two nodes needs to rely on the auxiliary forwarding of the coordinator to complete the communication. The typical characteristic of T-tree topology is that the terminal node can only send data to its parent node. The most important feature of the mesh structure is that routers can communicate with each other, and they can communicate without passing through their parent nodes.

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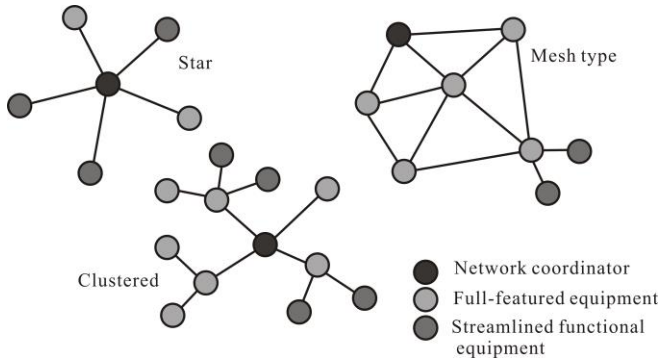

Figure 4. Schematic diagram of three topological structures of zigbee.

The application of the summary point of the intelligent agricultural monitoring system is mainly to effectively coordinate other servers, so that a more effective link can be formed between the information and the gateway. The reason for adopting the mode of combining two nodes is that it is hoped that effective control of different nodes can be realized through this method. In addition, this method can also realize routing control to different rooms at the same time. At the end of the system, connecting other nodes to other devices in the system can help users monitor different houses simultaneously.

(1) Router node: When designing the system, the corresponding router node is added appropriately, mainly to facilitate the transmission of information. In the system, the main function of the router node is to effectively distinguish the subnets of different rooms, so that the devices in different rooms have corresponding nodes. When the devices are combined, it is more convenient and faster to choose to combine the nodes (3). The router node can realize the connection between the software and the internal network, and transfer the information obtained by the software to the internal network in time. In addition, through the addition of router nodes, a more comprehensive control of the addresses allocated in the device can be achieved. The router node can also collect information, collect the surrounding situation and information regularly, and send it to the corresponding data software for information analysis. After that, the analyzed and adjusted information is transmitted to the router through the coordinator node, so that users can grasp the information of different rooms at the same time.

(2) Device node: Since different devices can perform their own functions in the node, the device node can be better designed through the corresponding software. They are mainly responsible for searching the network and joining in time, and then corresponding The information and data are sent to the corresponding software. Therefore, the function of each node needs to be designed in this system. The device node mainly plays the following roles in the system: 1) It can independently send the network access status of each node to different coordinators. 2) It has better receiving and information functions, can effectively execute a fixed control process, and provide a corresponding structure for the timely coordinator node.

(3) Coordinator component: In the design of the intelligent agricultural wireless monitoring system, the key is to realize the connection between the gateway and the serial line in the home through the combination of nodes and software, so as to realize the effective monitoring of intelligent agriculture. In the internal network of this system, ZigBee mainly plays the role of controlling and regulating nodes, helping the system to establish a network structure that can operate in an orderly manner more quickly. At the same time, it enables the system to forward and analyze real-time information through the network entrance. Therefore, the existence of the coordinator in this system is essential. The existence of the coordinator can capture the address and other important information in it as soon as a new node enters, and send the information to the gateway in time. In addition, when the gateway receives the command and analyzes the command, it can grasp the situation of the corresponding device, and can send the information to the corresponding device, so as to achieve the purpose of effective information transmission.

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6. Monitoring system function design and performance test

According to the functional principle of the remote monitoring system of the planter, the remote monitoring system of the feeder is designed. Based on the Internet of Things technology, the remote monitoring system of the intelligent agricultural feeder is composed of 4 parts: data acquisition system, data transmission system, data processing system and alarm system.

Data collection mainly uses various sensors, including ambient temperature and humidity sensors and cameras. Data transmission is through the Internet of Things communication technology, such as long distances can be through GPRS, such as closer distances can use WIFI communication. The data processing system mainly adopts the form of a database to analyze and process various collected data. During data analysis, the corresponding alarm threshold will be set, and an alarm will be issued when the collected data exceeds the corresponding threshold.

During the working process of the feeding machine, the feeding process parameters and related data can be monitored through real-time monitoring, and displayed in real-time in the form of configuration diagrams or reports and curves, such as the total feeding time, feeding mixing density, discharge temperature and environment Material concentration, etc. The purpose of real-time monitoring is to provide early warning when the feeding parameters are unqualified or the environmental pollution is severe. Through the monitoring system, when the feeding parameters do not meet the standard or exceed the set threshold, the system will issue an alarm, and finally the real-time monitoring data will be made into various forms of reports to support historical query and data statistical analysis.

In the test system, system debugging can play a very active role. People can quickly grasp the role of communication when debugging different home appliances in the home network, and at the same time it can play an active role in different nodes. In this way, the goal of people receiving information through mobile phones can be achieved. In order to realize the function of remote monitoring in the monitoring system, when debugging the system, it is necessary to debug and verify the connection between the gateway and the client. You can log in to the Weibo platform through the gateway software. After logging in, you can set different permissions according to the different needs of customers. In order to verify the effectiveness of the system function, the user's authority can be modified during debugging.

The intelligent agricultural feeder can successfully count the blowing time after adopting the monitoring system, as shown in Table 1. In order to further study the feasibility of the monitoring system, the blowing quality was monitored, and the results shown in Table 2 were obtained through statistical analysis of data.

Table 1. Monitoring of material blowing time of feeder.

Test number	Blowing material quality/kg	Blowing time/s
1	5	122
2	10	189
3	15	232
4	20	396
5	25	456
6	30	558

Table 2. Quality error of material blown by feeder.

Test number	Blowing material quality/kg	Error/%
1	5	1.2
2	10	0.8
3	15	0.7
4	20	1.3
5	25	1.5
6	30	0.9

It can be seen from Table 2: The feeding error is counted by the monitoring system, and the error

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result is only 1.5%. Within this error range, the accuracy of feeding is within the design range, and it will not pollute the environment and meet the design requirements.

7. Conclusion

In order to improve the automation and remote monitoring level of the feeder, the remote planter system is introduced into the monitoring system design process of the intelligent agricultural feeder, which realizes the data collection and transmission, data monitoring, analysis, statistics, management and alarm of the feeding process Comprehensive functions such as processing. In order to verify the feasibility and reliability of the system, the feeding process was monitored. The results showed that the remote monitoring system can successfully monitor the feeding quality and efficiency, and provide technical support for the automatic control of the feeding process.

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