

Data Transmission Method of Farmland Production Monitoring System Based on Internet of Things

Shiwei Sun, Hongyan Sun, Huiting Sun, Xuxuan Zhao, Youwei Yu

University of Science and Technology Liaoning, Liaoning, China

Abstract: The invention discloses a data transmission method of farmland production monitoring system based on the Internet of Things, which belongs to the field of agricultural Internet of Things. The agricultural Internet of Things system includes an Internet of Things perception layer, an Internet of Things network layer and an application layer. The Internet of Things perception layer transmits the received information to the application layer through the Internet of Things network layer by wired or wireless network; A plurality of test instruments and equipment collect farmland crop data, and a plurality of wireless transmission modules collect farmland data and transmit them to the data management platform, which queries and calls farmland data in real time. In this design, the obtained field data can be imported into the storage location accurately and quickly, and the data of each site can be collected into a data management platform. It can monitor the equipment status and data quality in real time, reduce the workload of testers and improve the data transmission speed and quality.

Keywords: Agriculture, Internet of Things, Distance, Farmland, Data transmission method.

1. Preface

The Internet of Things refers to the Internet where things are connected. It connects everything with the Internet for information communication through various information sensing devices, so as to realize intelligent network management. Relying on the development of Internet of Things, agricultural informatization is developing rapidly in China, and more and more Internet of Things technologies can be used in agriculture. Agricultural Internet of Things is an indispensable link on the road of China becoming a modern power, which will inject fresh vitality into the high-quality development of agriculture.

In the field of farmland observation in China, the development and application of wireless data transmission started late. Although it developed rapidly, the research and application of agricultural experiment, production monitoring and data collection lagged behind developed countries. "For the rapid development of precision agriculture, one of the important links is the real-time collection, transmission and processing of field data". It can be seen that, In order to realize the systematic development of China's agricultural Internet of Things, reduce the cost of agricultural production, and improve the quality and efficiency, we must lay a good foundation from the source, obtain accurate and timely field data, and then establish a complete data network from all aspects.

For example, an agricultural Internet of Things system based on ZigBee module includes a client, a cloud server and a device. The equipment terminal mainly includes coordinator-microcontroller module, router module, terminal—RS485 module, terminal-sensor module and terminal-relay module. Coordinator-micro-control module is responsible for the control of all modules of the whole equipment and the establishment of ZigBee network; Terminal-sensor module is responsible for collecting and sending sensor data; Terminal-the relay module is responsible for controlling the relay, thus controlling the execution unit; Terminal-RS485 module is responsible for communicating with devices that adopt RS485 communication protocol, monitoring and controlling

these devices. However, different wireless transmission modes have their own advantages and disadvantages. ZigBee module has low cost and strong reliability, but the transmission rate is small. Therefore, it is necessary to construct a more reasonable data transmission scheme according to the actual situation of farmland test station. Shiyanghe Experimental Station, located in Wuwei City, Gansu Province, northwest China, has been conducting field experiments for a long time, and the data collection consumes a lot of manpower and material resources.

Based on this, this paper designs a design scheme of data collection, wireless network transmission and data management platform of agricultural Internet of Things, in order to liberate human labor, improve work efficiency and quality, and provide some reference for subsequent work deployment.

2. Design Content

The purpose of this design is to provide a data transmission method of farmland production monitoring system based on the Internet of Things; Characterized in that the agricultural Internet of Things system comprises an Internet of Things perception layer, an Internet of Things network layer and an application layer; Among them,

The sensing layer of the Internet of Things is the instrument equipment of the test station, that is, the sensor equipment used to sense external objects and collect data information; Include vorticity correlation system, large-scale weighing lysimeter, stem flow meter, EM50 soil moisture probe and weather station.

The Internet of Things network layer, that is, the information received by the perception layer is transmitted to the application layer through wired or wireless networks. Comprise a wireless bridge, a 5G wireless transmission module and a Zigbee transmission mode.

The application layer of the Internet of Things is a data management platform, which can query and call the information of different substations in real time, including site name, data category, data name and observation elements.

Long-distance farmland data transmission method of

Internet of Things system: Characterized in that the Internet of Things perception layer transmits the received information to the application layer through the Internet of Things network layer in a wired or wireless network mode; Among them, the wired transmission mode is used in the conditional short-distance data transmission area; When wiring is difficult in traditional monitoring, it is necessary to build local area network as AP to cover hot spots, and choose wireless bridge transmission mode; For remote monitoring, remote control and data collection.

Beidou network and GPRS network are selected as the transmission mode of wireless bridge.

In the case of static network, a large number of devices, infrequent use and small data packets, Zigbee transmission mode is selected.

Bluetooth transmission mode is selected when the content transmission of files, wireless audio, pictures and screen images is involved.

Fast and stable data transmission adopts the 5G wireless transmission module of the fifth generation mobile communication technology.

The data from the application layer is integrated into the data management platform for processing. The data management platform can query and call the information of different sub-stations in real time, including site name, data category, data name and observation elements.

3. Concrete Realization

This design provides a data transmission method of farmland production monitoring system based on the Internet of Things; Agricultural Internet of Things system includes Internet of Things perception layer, Internet of Things network layer and application layer; Among them, the sensing layer of the Internet of Things is the instrument and equipment of the test station, that is, the sensor equipment used to sense external objects and collect data information; Comprises a vorticity correlation system, a large-scale weighing lysimeter, Stem flow meter, EM50 soil moisture probe and weather station.

The Internet of Things network layer, that is, the information received by the perception layer is transmitted to the application layer through wired or wireless networks. Comprise a wireless bridge, a 5G wireless transmission module and a Zigbee transmission mode.

The application layer of the Internet of Things is a data management platform, which can query and call the information of different substations in real time, including site name, data category, data name and observation elements.

According to the three-tier architecture of the Internet of Things, a farmland data transmission scheme based on the agricultural Internet of Things system is constructed, which is suitable for Shiyanghe Experimental Station in Wuwei City, Gansu Province.

The sensing layer of the Internet of Things is the instrument equipment of the test station, that is, the sensor equipment used to sense external objects and collect data information, including vorticity correlation system, large-scale weighing lysimeter, stem flow meter, EM50 soil moisture probe, weather station and other equipment.

There are 24m flux tower, weather station, large-scale lysimeter, EM50 soil moisture probe, EC150 vorticity system and KH20 vorticity system in the station. Outside the station, Li-7500 vorticity system, EC150 vorticity system and their ancillary equipment are arranged.

In-station equipment: the 24m flux tower selects one pair of network optical fiber conversion modules, 500 meters of optical fiber +NL115 wireless transmission module+ten-port router; The weather station selects NI240 wireless module; NI240 wireless module is selected for large-scale lysimeter. EM50 soil moisture probe adopts NI240 wireless module; NI240 wireless module is selected for the stem flow meter installed on the 24m flux tower. EC150 vorticity system uses a pair of wireless bridges; KH20 vorticity system uses a pair of wireless bridges.

Off-site equipment: EC150 selects one pair of wireless bridges; A pair of wireless bridges is selected for the video surveillance system matching with EC150 vorticity system. A pair of ZigBee radio stations is selected as the stem flow meter visible to EC150 vorticity system. The radiation system visible to EC150 vorticity system selects a pair of ZigBee radio stations.

Li-7500 vorticity system selects a pair of wireless bridges and 5G communication module. The video monitoring system matching with Li-7500 vorticity system selects a pair of wireless bridges; The stem flow meter visible to Li-7500 vorticity system uses a pair of ZigBee radio stations; The EM50 soil moisture probe visible to Li-7500 vorticity system uses a pair of ZigBee radio stations.

The application layer of the Internet of Things is a data management platform, which can query and call the information of different substations in real time, including site name, data category, data name, observation elements and so on.

The data management platform contains basic data management system, including site management, equipment information management, user management, system authority, system log and data audit rules.

In addition, the data management platform contains databases that can query and call the information of each substation in real time, including meteorological data, hydrological data, soil data and video.

Long-distance farmland data transmission method of Internet of Things system: The Internet of Things perception layer transmits the received information to the application layer through the Internet of Things network layer by wired or wireless network; Among them, the wired transmission mode is used in the conditional short-distance data transmission area; When wiring is difficult in traditional monitoring, it is necessary to build local area network as AP to cover hot spots. And choose the wireless bridge transmission mode; For remote monitoring, remote control and data collection.

4. Concluding Remarks

Based on the existing instruments and equipment in the test station and according to the environmental conditions arranged by each instrument and equipment, this design constructs a data wireless transmission system, which enables the field data to be accurately and quickly imported into the storage location, and the growth of the field crops and the real-time data status can be always observed at the test station thousands of miles away from Beijing. Moreover, the data of each site is collected into a data management platform, which can monitor the equipment status and data quality in real time, reduce the workload of testers and improve the data transmission speed and quality.

Acknowledgment

Supported by the 2022 undergraduate innovation and entrepreneurship training program of Liaoning University of science and technology.

References

- [1] Wang Xu, Zhou Kaili. "Six-domain Model" Reference Architecture and Application of Agricultural Internet of Things [J]. Modern Electronic Technology, 2022,45(06):53-57.
- [2] Zhou Aijun, Miao Xiaolong. Development status and countermeasures of agricultural Internet of Things in Rudong County [J]. Modern Agricultural Science and Technology, 2022,(04):232-234.
- [3] Ren Ling, Xia Jun, Zhai Xujun, Liu Zhengwei, Qi Yuqiang. Realization of intelligent greenhouse system based on agricultural Internet of Things technology [J]. Southern Agricultural Machinery, 2022,53(03):5-10.
- [4] Lu Tiangang, Zhang Huixin, Tang Dynasty, Zhang Hua, Wang Jian. Research on intelligent control system of solar greenhouse based on agricultural Internet of Things [J]. Modern Agricultural Science and Technology, 2022, (02):147-151.
- [5] Yang Mingtai. Agricultural Internet of Things technology application and innovative development strategy [J]. New Agriculture, 2022, (02):82.