ISSN: 1813-4890

Design and implementation of remote farmland monitoring system

Yiming Liu, Chuansheng Wu

Liaoning University of Science and Technology, China

Abstract

4G network is the most widely used remote communication technology at present. Applying 4G network to the remote monitoring system of farmland irrigation can better support the system data transmission.This paper designs and develops a remote monitoring system for farmland irrigation based on 4G network, which is divided into field data acquisition terminal, server terminal and client terminal. The field data acquisition terminal is composed of camera, sensor and data acquisition module;The server is composed of management module, storage module and communication module;The client is composed of data decoding module, information analysis module and remote video viewing module.The system development adopts ARM microprocessor platform and JAVA, JAVAEE, ObjC, C and other languages respectively.According to the test results, the relevant functions and performance of the system are good, and there is a large load capacity.

Keywords

4G network;Farmland irrigation;Remote monitoring.

1. Preface

Farmland is an inexorable natural resource. How to improve the productivity, economic benefits and environmental benefits of farmland with advanced scientific and technological means on the basis of limited farmland resources has become a major issue that must be solved in China. The integration of information technology and agricultural technology provides a way to solve the above problems.

In the past, farmers often relied on experience to manage greenhouses, which easily affected the timeliness and scientificity of crop management in greenhouses.At present, the IOT farmland monitoring system proposed at home and abroad using the integration of information technology and agricultural technology usually collects environmental data from multiple locations in farmland, and then transmits it to the monitoring center for monitoring, so as to achieve efficient monitoring and management of large areas of farmland. However, these existing systems are often large in size, high in cost, high in power consumption, and complex in equipment,It is only suitable for large-scale farmland and difficult to promote, so it is very necessary to provide a simple structure, low cost and efficient monitoring Internet of Things farmland monitoring system.

2. System working principle and design

2.1. System working principle

As the fourth generation mobile communication technology, 4G has better improved 3G technology, making information transmission faster and able to transmit clear images and videos [5].In addition to installing cameras and sensors on the site, the traditional remote monitoring system for farmland irrigation also requires complex wiring, and the system development cost is high [6].This system introduces 4G technology, which is divided into three

ISSN: 1813-4890

endpoints: on-site data acquisition end, server end, and client end, connected by 4G network, and data information is transmitted quickly through 4G network.

2.2. System design

The remote monitoring system for farmland irrigation based on 4G network consists of field data acquisition terminal, server terminal and client terminal. The field data acquisition terminal mainly collects water level information through cameras, sensors and data acquisition modules, and then transmits it to the server terminal through 4G network.There are three modules on the server side: management module, storage module and communication module.The management module is responsible for receiving and dispatching information, the storage module is responsible for storing information, and the communication module is responsible for transmitting effective information to the client through the 4G network.There are also three modules in the client: data decoding module, information analysis module, and remote video viewing module.The data decoding module is responsible for decoding the data, the information analysis module is responsible for analyzing the on-site information, and the remote video viewing module is responsible for connecting the on-site camera to view the on-site water level in real time.

3. Project content

Technical problems to be solved by the project

The project provides a remote farmland monitoring system to solve the technical problems of the existing farmland monitoring system proposed in the above background technology, such as large volume, high cost, large power consumption and complex equipment.

Technical proposal

To achieve the above purposes, the technical scheme provided by the project is: remote farmland monitoring system, including the greenhouse body, which is equipped with environmental monitoring module, pest control module, photo module, power module, master control module, relay module, lighting supplement module, temperature and humidity supplement module, communication module and terminal;

The environmental monitoring module is used to detect the temperature, humidity and gas changes in the greenhouse body, and transmit the detected information to the main control module;

The pest control module uses multiple pest forecasting lights for pest control;

The photographing module uses the camera to shoot regularly and send the captured photos to the main control module;

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

The light 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 controls the temperature and humidity in the shed by the main control module;

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

The main body of the greenhouse is hinged with a plurality of roof, among which electromagnets are used for adsorption, and the roof is fixedly connected with a rotating rod. One end of the rotating rod is fixedly connected with a motor. The roof is equipped with an electrically retractable sunshade, one side of which is equipped with an electrically retractable

ISSN: 1813-4890

ventilation curtain, and the roof is equipped with a plurality of pressure sensors, which feed back the detected information to the main control module.

The environmental detection module is placed in the greenhouse body, and the environmental detection module includes multiple temperature and humidity sensors, multiple light intensity sensors and gas analyzers. The temperature and humidity sensors, light intensity sensors and gas analyzers send the obtained environmental information in the greenhouse to the main control module.

The light supplement module includes multiple plant fill lights. The height of the plant fill lights is 1.5 meters from the growth point. Multiple plant fill lights are hung in multiple rows, and multiple plant fill lights are electrically connected to the main control module.

The temperature and humidity supplement module includes a plurality of ground rail heating tubes and a plurality of water mist sprinklers. A plurality of ground rail heating tubes are evenly laid in the greenhouse body. A plurality of water mist sprinklers are connected to the water source, and the spraying control is carried out by using solenoid valves. A plurality of ground rail heating tubes and solenoid valves are electrically connected to the main control module.

4. System test

The field data acquisition end of the system is developed using the ARM microprocessor platform;The server side is developed using JAVA language, and the database is MySql database;Android client is developed using JAVAEE language, and Apple client is developed using ObjC and C language.In the process of system development, the relevant functions and performance of the on-site data acquisition end, server end, Android client and Apple client were tested respectively.Further test the load capacity of the system, and set the number of concurrent connections to 30, that is, the load pressure on the server caused by 30 clients logging into the system at the same time.From the relevant function and performance test results of the system, it can be seen that in terms of user login, administrator users successfully log in on the server side, and ordinary users successfully log in on the Android client and Apple client, indicating that the system has good login function.In terms of data transmission, the data transmission speed of the field data acquisition end reaches 8 M/s, and the data transmission speed of the server end and the client end reaches 10 M/s, which indicates that the data transmission speed of the 4G network is fast and can basically meet customer needs.In terms of data encoding and decoding, each test point can successfully encode and decode, indicating that the system has good encoding and decoding functions.In terms of data storage, the server can successfully store data.In terms of video definition, the video data of each test point is kept in high definition.It can be seen from the system load capacity test results that when 30 people are online at the same time, the load pressure on the server side is below 2.5%, indicating that the system load capacity is good. In practice, the number of people online at the same time is usually only 3-5

5. Conclusion

Compared with the existing technology, the technical scheme provided by this project has the following beneficial effects:

The structure design of the project is reasonable. The environmental detection module is used to monitor the temperature, humidity and gas changes in the shed, and the single-chip microcomputer and relay are used to control the large with the small to achieve the automatic control of light compensation, humidification, temperature rise and fall, and ventilation in the shed, and can detect data and send alarm signals. The equipment is simple and the cost is low;In

addition, the roof is designed to be rotatable. When the pressure reaches the preset value in snowy weather, the roof can be unscrewed to increase the service life of the roof.

Acknowledgemts

Innovation and Entrepreneurship Project of Liaoning University of Science and Technology.

References

[1] Design of remote video system and discussion on application of different scenes [J]Ye Hai. Modern TV Technology, 2020 (11).

[2] Development of remote video aided maintenance system for belt conveyor [J]Zhang Dawei;Ma Hongwei;Cao Xiangang;Dong Ming. Coal Technology, 2016 (10).

[3] Implementation of the hospital remote video recruitment scoring system [J]Hu Mingjian;Wang Jin. China Digital Medicine, 2012 (02).

[4] Design analysis of remote video transmission in water regime monitoring in the upper reaches of the Yellow River [J]Hao Yanhao;Zhao Jingxin, Inner Mongolia Water Conservancy, 2022 (09).

[5] Emergency drill of 3G network remote video control command system [J]Ouyang Tingting;Du Mingyan;Deng Lijuan, Yunnan Electric Power, 2014 (04).

[6] Design of remote video and data processing platform based on Internet of Things [J]Feng Yingwei;Liu Jiwen;Wang Qingfu. Computer Programming Skills and Maintenance, 2021 (10).

[7] Remote video control based on intrusion detection technology [J]Zhang Weifeng;Zhang Zhao;Fenghai. Electronic World, 2014 (10).

[8] Design of adaptive remote video transmission equipment for mobile network and wired network [J]Lin Xiao;Wu Yi;Cai Jianyong, Industrial Control Computer, 2009 (10).

[9] Application of remote video technology in network NC machining monitoring [J]Huang Zhan, Long Wei, Huang Jie. Machinery, 2002 (02).

[10] Design of data acquisition module based on Wi Fi [J]Chen Hewei, Electronic World, 2019 (23).