

LETTER TO THE EDITOR

Design of Abnormal Monitoring System for Agricultural Bioinformatics Based on Wireless Sensor

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The invasion and spread of abnormal biological species have caused serious losses to the agricultural ecological environment. Using wireless sensor and database technology, this paper designs an abnormal monitoring system for agricultural biology species information. The system consists of agricultural ecological environment, sensors, base stations and remote monitoring centers. On this basis, a wireless sensor node structure and a database for identification and monitoring of abnormal biological species in agricultural ecological environment are designed and created. Empirical results show that the system can effectively identify the abnormal biological species in the agricultural ecological environment. The monitoring range is comprehensive, and it has a high timeliness and obvious application advantages.

Sensors; Agricultural ecological environment; Biological species; Abnormal information; Monitoring

1 INTRODUCTION

Monitoring the abnormal situation of agricultural biology information can effectively realize the supervision of agricultural biology information and the maintenance of agricultural ecological environment. In recent years, with the intensification of economic globalization and other human activities, the opportunities for the introduction and dissemination of exotic organisms have increased dramatically either intentionally or unintentionally (Kumar 2017, Mi et al. 2015, Zorpas et al. 2018). Moreover, the vast territory of China and the highly diversified climate and geographical conditions make it possible for most exotic organisms to find suitable habitats. Generally, the agro-ecosystem will be in a relatively stable state, and there is a dynamic balance between the various species in the system. If invaded by exotic organisms and under suitable conditions, the increase of invasive species will destroy the naturalness and integrity of the agricultural ecological environment, destroy the original stable state of the agricultural ecosystem, and ultimately affect human life. Therefore, it is very necessary and urgent to monitor the abnormal information of biological species in agro-ecosystem.

In recent years, wireless sensor networks (WSNs) have been applied to anomaly monitoring of agricultural biology information due to their advantages of low power consumption and cost, large network scope and network capacity, simple and flexible networking, and focusing on low-speed transmission, which provides a good idea and application prospect for anomaly monitoring of agricultural biology information (Zhao 2017).

Zhang et al. (2018) published an article in the journal Ekoloji (Issue 106, 2018), entitled "Forest Vegetation Type Extraction and Dynamic Monitoring - A Case Study of Heilongjiang Province, China". This paper aims to

monitor forest vegetation succession or dynamic change mode. Taking Heilongjiang Province as the experimental area and TM image as the basic data, maximum likelihood classification and support vector machine classification were used to extract forest vegetation type information. At the same time, by extracting the change information and superimposing analysis, the dynamic changes of large-scale forest vegetation types were monitored, to propose sustainable forest development. Based on this article, the scope of monitoring can be expanded to monitor the anomalies of comprehensive agricultural biological species information.

Jiang et al. (2016) proposed a pretreatment study of crop monitoring data based on clustering and anomaly detection, which proposed a crop information detection system based on anomaly detection, to classify the multidimensional time series data obtained by monitoring, and then obtain continuous and comprehensive and uniform time period. Based on this, appropriate anomaly detection criteria was selected according to the size of sample data for anomaly crop information detection and processing. Jin and Yao (2018) designed a monitoring system for agricultural soil moisture content that can monitor crops in real time, including the front-end information collection station and background processing software. Among them, the acquisition station could transmit the data collected by the sensor layer back to the background through GPRS wireless communication technology, and the background software could store and analyze the data persistently, so as to realize the real-time monitoring of agricultural biological information. However, the performance of the above two methods in the information acquisition phase is low, resulting in insufficient monitoring.

To this end, this paper proposes an anomaly monitoring system for agricultural biological species information based on wireless sensor, which aims to use the wireless sensor network to effectively monitor and judge foreign organisms in the agro-ecosystem, and provide support for the sustainable and stable development of the agricultural environment.

2 IDEA DESCRIPTION

2.1 Analysis of research status

At present, the research on abnormal information of biological species in agro-ecosystem has a long history, but the research what really attracts scientists' attention is from the late 20th century (Yu et al. 2016). Especially in recent years, the research on foreign invasive organisms has integrated molecular biology, molecular ecology, ecological genetics, biochemistry and biomathematics from macro-prevention and control strategies, and effective and feasible control and management technology system to micro-molecular biology and ecology, ecological genetics, co-evolution and control technology and mechanism of ecological restoration. The research level of invasive mechanism of agricultural alien organisms has been greatly improved by industrial and technological methods, which has promoted the development of invasive biology. At present, the invasive mechanism of agricultural alien organisms has become a research hotspot of ecology and biodiversity science (Xia 2017).

2.2 Overall design of system

As shown in Figure 1, the overall structure of the monitoring system based on wireless sensor for abnormal agricultural biological species information is shown. The system consists of agricultural ecological environment, sensors, base stations, remote monitoring centers and abnormal information identification and monitoring database of biological species. The system information flow is shown in Figure 2. Infrared sensors and composite sensors are deployed in the agricultural ecological environment. Abnormal biological information is transmitted to the base station computer through ZigBee wireless sensor network. The base station computer automatically analyzes the abnormal biological species information and outputs the results through ZigBee wireless sensor network, which provides support for the monitoring and post-control of the abnormal biological species

information. At the same time, the base station computer can display the monitoring and control process information in real time, and share the information with the remote monitoring center through the Internet.

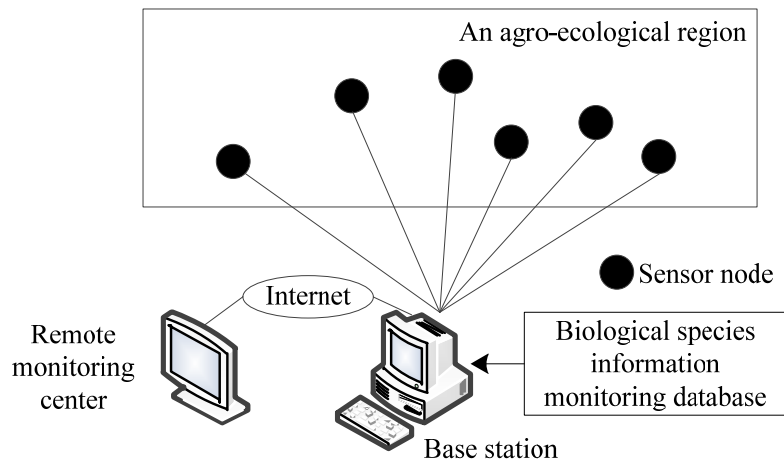


Figure 1 System overall structure

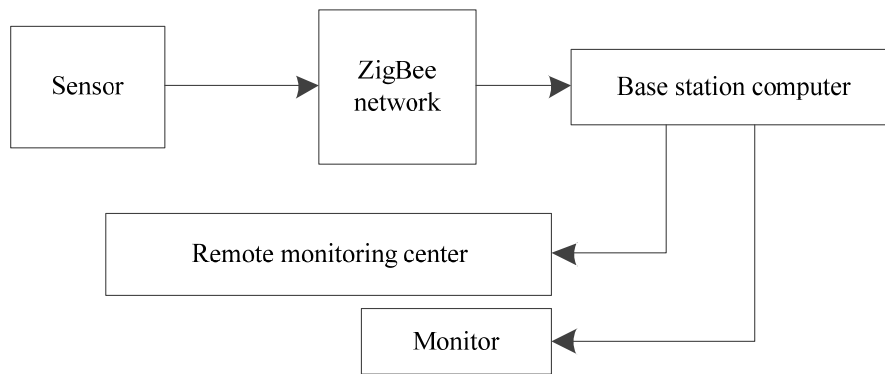


Figure 2 Information flow diagram

2.3 Structure design of wireless sensor node

Wireless sensor node design is an important part of system design. Wireless sensor node is a miniature embedded node with information processing and communication capabilities (Niu et al. 2017). In this system, the nodes are modularized, and the structure diagram is shown in Figure 3. JN5139 wireless microprocessor module is as the core to extend the ZigBee wireless transmission unit, serial communication interface, sensor interface, digital output interface and power supply interface, thus constituting the core board.

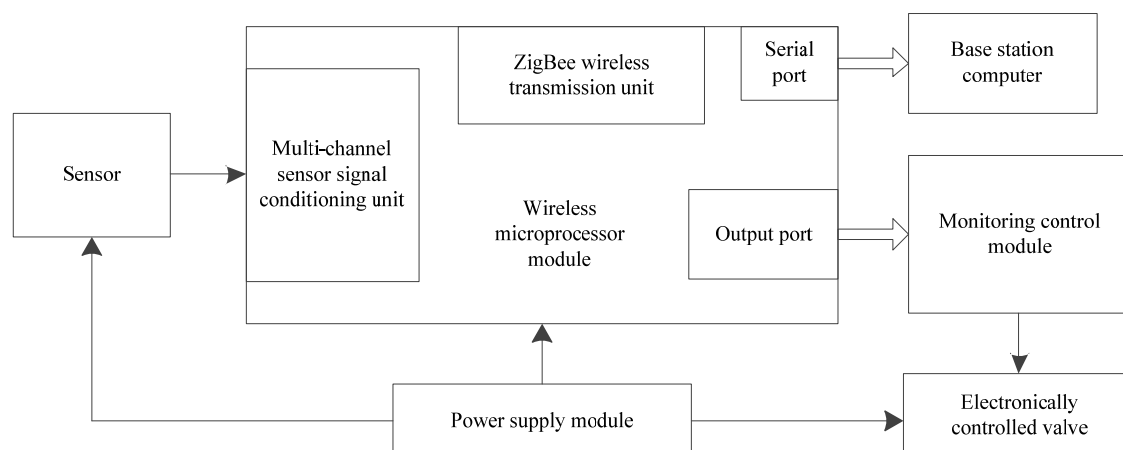


Figure 3 Sensor node structure diagram

2.4 Establishment of database for identification and monitoring of abnormal biological species in agricultural ecological environment

Double-click Microsoft Visual Studio 2005 to open its home page, and select [File] - [New] - [Project] to open the [New Project] dialog box. In the [New Project] dialog box, select Visual c#/Windows in the [Project Type] list box, and select the Windows application in the [Template] list box. Then enter "Abnormal Species" in the [Name] text box, and select "Abnormal Species" in the [Position] text box. Select [Create a directory for the solution], and click the OK button to complete the creation of the identified monitoring item.

A form is automatically generated when creating a project that identifies a monitoring project: Form1. Right-click on the Form1 form, click on the Properties dialog box, change the Text property of "Form1" to "Abnormal Biological Information Consulting System", then right-click "Form1" in the "Solution Resource Manager" and select "Rename", change "Form1" to "Main Window". Drag the mainMenu control from the toolbox to the main form, it can see that the mainMenu is added below the main form. Enter menu items one by one in the blank of "Please Type Here", and edit the main menu.

The main form of database is composed of menu and status bar. The menu of the database can call each function sub-form, realize various related operations, and complete the corresponding identification and monitoring functions.

3 RESULTS

An experiment is carried out in an agro-ecological park using the abnormal information monitoring system of agro-biological species based on wireless sensor designed in this paper. Infrared sensors and composite sensors are installed at several fixed monitoring points in the park, and the biological species in the park are detected regularly. The abnormal biological species are identified and monitored by the base station computer. The experimental results show that the system can effectively identify the abnormal biological species, the monitoring range is comprehensive, and the timeliness is high, which proves that the system has high reliability. In addition, the overall operation of the system is stable and practical.

4 DISCUSSION

The situation of biological invasion of abnormal species in China is very serious, and the spread and outbreak of invasive species are constantly abrupt. The invasion of dangerous species poses a great threat to the agricultural ecological environment, and preventing the invasion of abnormal species has become the focus.

Therefore, the monitoring system based on wireless sensor is very practical, and it can identify and monitor the abnormal species in the agricultural ecological environment, which provides great support for the prevention of the abnormal species in the agricultural ecosystem.

5 CONCLUSION

In order to effectively and timely monitor the abnormal biological species in agricultural ecological environment, this paper designs an abnormal information monitoring system of agricultural biological species using wireless sensor technology. The system is composed of agricultural ecological environment, sensors, base stations, remote monitoring center and identification and information monitoring database of abnormal biological species in agricultural ecological environment. The node structure of wireless sensor is designed in detail. The experimental results show that the system can effectively and timely identify the abnormal biological species in the agricultural ecological environment, and the monitoring scope is wide and the timeliness is high. It can effectively provide support for the monitoring of abnormal biological species in the agricultural ecological environment.

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