

Retraction

Retracted: Optimization and Simulation of Farmland Protection Dynamic Monitoring System Based on Internet of Things Technology

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their

agreement or disagreement to this retraction. We have kept a record of any response received.

References

- [1] B. Hu, W. Zhang, T. Ma, and Z. Zhao, "Optimization and Simulation of Farmland Protection Dynamic Monitoring System Based on Internet of Things Technology," *Wireless Communications and Mobile Computing*, vol. 2021, Article ID 6902998, 11 pages, 2021.

Research Article

Optimization and Simulation of Farmland Protection Dynamic Monitoring System Based on Internet of Things Technology

Bixia Hu,¹ Wei Zhang,² Tao Ma,¹ and Zhizhong Zhao ^{1,3}

¹College of Agriculture and Animal Husbandry, Qinghai University, Xining, Qinghai 810016, China

²Qinghai Youyuan Space Information Technology Co., Ltd., Xining, Qinghai 810001, China

³Qinghai Minzu University, Xining, Qinghai 810007, China

Correspondence should be addressed to Zhizhong Zhao; 1989990003@qhu.edu.cn

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Based on the status quo of cultivated land, this paper analyzes the existing problems and builds a dynamic monitoring system for cultivated land protection. It works by using the Internet of Things technology and geographic and national conditions to realize the systematization, informatization, and socialization of cultivated land protection, thereby promoting the sustainable development of cultivated land and social stability and harmony. This paper puts forward relevant countermeasures and suggestions for the protection of cultivated land. This paper constructs the farmland protection dynamic monitoring system, proposes the goals of the system construction, points out the ideas of the system construction, and designs and analyzes the key points of the system composition. The system includes seven subsystems, and the functions and specific contents of the subsystems are explained, respectively, to build the entire system. Then, we put forward the financial, technical, and implementation problems of the system, and find out countermeasures, expand the system research, propose the development of the dynamic monitoring system of cultivated land protection in the direction of intelligence and convenience, and expand the application to food safety and disasters. In terms of forecasting, comprehensive evaluation of the existence and operation of the system is carried out by designing evaluation indicators and weights for the operation of the system.

1. Introduction

Cultivated land is the basis for humans to obtain food, the source of human existence, and the most basic condition for human existence. Cultivated land is a scarce resource, which is reflected by its limited quantity and limited quality. Overutilization and development of land by humans will reduce the carrying capacity of land and deplete cultivated land resources [1]. At present, the increasing demand for land in the process of social and economic development and urbanization determines that we must protect arable land. The problems of food, construction, and environmental protection that we want to solve must start with the protection of arable land. The quantity and quality of arable land and the sustainable development of arable land ensure food security and social stability [2]. At present, the agricultural information intelligent monitoring system based on the Windows system has been widely used in the field of agricultural Internet of Things. The research

mode is mostly to use a large number of node networking to collect data, and use the equipment to embed the GPRS module for remote data transmission [3]. However, the open source and free of charge and human-computer interaction of such systems are not high, and they are obviously restricted by the wired network environment.

Making full use of Android platform resources in agricultural production environment monitoring and field management technology is important. It can not only efficiently and accurately obtain field information and guide agricultural production but also reduce the cost of intelligent agricultural monitoring terminals [4]. The platform has been applied to many fields in the process of agricultural production, and research on farmland information collection and field management has been extensive, such as the collection of agricultural Internet of Things field information, the collection of shed environmental data, and the collection and identification of images of rice diseases and insect pests. It has a

huge role and guiding significance for agricultural production and precision agriculture. The network-based farmland protection dynamic monitoring system increases the signal transmission strength and rate, but the data transmission distance is limited, data storage is not supported by a database, and it is unable to carry out long-distance transmission and storage and processing of large amounts of data [5]. At present, the development of soil proximity sensors, Internet technology, and agricultural information technology has made it possible for the Internet of Things to be applied to cultivated land quality protection, but the innovation of soil information detection methods and the delineation of soil quality standards are still restrictive factors. It is necessary to strengthen the research of soil quality protection and improvement technology, so that the Internet of Things technology and cultivated land quality protection work better match, realize the intelligent management of cultivated land quality protection work, and better guarantee the quality and safety of agricultural products from the source [6].

This article first describes the current situation and development of domestic and foreign Internet of Things technology and geographic national conditions monitoring, expounds the current situation of cultivated land, analyzes existing problems, and finds out the key points that need to be addressed and resolved in cultivated land protection. Its goal is mainly to achieve the quantity and quality of cultivated land about continuous improvement, pointing out the content and importance of dynamic monitoring of the quantity and quality of cultivated land. Secondly, it expounds the Internet of Things technology and geographic national conditions monitoring, summarizes the relationship between the two, proposes the concept of the integration of sensors and 3S technology, and analyzes the role of the two key technologies in constructing a dynamic monitoring system for cultivated land protection. This paper proposes to strengthen the dynamic monitoring of cultivated land protection, strengthen the technical means of cultivated land protection, and explore the construction of the dynamic monitoring system of cultivated land protection. Introducing public participation and strengthening supervision can help achieve the dynamic balance of the total cultivated land and real-time monitoring of cultivated land quality, accurately grasp the cultivated land information and predict its development trend, and provide assistance for the sustainable use of cultivated land and the stable, harmonious, and healthy development of society. This article tests the soil multiparameter acquisition and transmission system based on the Internet of Things, and conducts communication performance tests and networking tests on wireless networks and ZigBee wireless sensor networks. We use a variety of sensors and a professional portable soil nutrient rapid measuring instrument to collect the temperature, humidity, pH value, nitrogen, phosphorus, potassium, and other parameters in the soil environment. This topic has two different designs for the different sizes of cultivated land areas. The wireless network transmission plan is completed, and the actual wireless transmission network is constructed to complete the data transmission. A professional APP has been developed to facilitate farmers to understand the basic parameters of the soil in real time, and to quickly provide farmers with scientific comprehensive fertilization recommendations.

2. Related Work

With the development of 3S technologies (RS, GIS, and GPS) combined with hyperspectral remote sensing technology to establish a model of soil quality information to quantitatively evaluate soil quality characteristics, this technology has also been applied to soil environmental pollution and soil pollution. Area desertification and soil erosion and other soil environmental monitoring research are studied [7]. The EU has integrated soil environmental data and information from all member states, analyzed and confirmed the factors affecting soil quality, and established a soil environmental assessment and monitoring project to further study changes in soil environmental quality. With the emergence of new technologies, the European Union has applied wireless sensor network technology to agricultural production to conduct online monitoring and analysis of environmental parameters in the soil, realizing the intelligent development of soil quality monitoring. The largest wireless sensor network in the world was built in the agricultural vineyards in the Central Valley of California, USA. Multiple sensor modules were used to collect sensor location information, soil temperature, humidity, and other data, which were transmitted through the wireless sensor network and stored in the server to analyze the data; the staff of the vineyard can conveniently view the data information of the vineyard anywhere through the Internet [8]. Wu et al. [9] relied on the mobile Internet to design an agricultural software to help farmers effectively predict agricultural production profits and track expenditures through digital means. The most important thing is to help farmers arrange production operations reasonably. Krishnan et al. [10] deployed a LoRa network system in some cities in Germany. The system performed positioning and tracking tests on urban taxis and inland watercraft, and the test results were good. Germany uses LoRa as the main communication solution for wireless communication in the Internet of Things and smart cities to promote the rapid development of local smart cities. Li et al. [11] used LoRa technology and the LoRa WAN open protocol to connect irrigation sensor equipment to the gateway, and use irrigation sensors to sense water level, iron content, and salt content in the soil. The system uses two-way communication at the terminal node and uses LoRa technology to perform the transmission of sensor data information and control instructions which enables farmers to understand field data information for more effective irrigation and field fertilization, so as to help farmers scientifically manage crops and increase crop yields [12].

With the country's research and breakthroughs in wireless sensor networks, the application areas continue to expand. At this stage, it can be used for environmental monitoring and protection, military field, soil testing, etc. At present, in the field of soil science research, wireless sensor networks are applied to the acquisition of soil information, especially the acquisition of farmland soil information, and certain achievements and technological progress have been made. Chen and Yang [13] used the processor and ZigBee technology produced by TI to build a wireless sensor network to remotely monitor the wetland water environment, which can collect information parameters such as temperature, oxygen

content, pH value, and turbidity of the wetland water environment, and the camera collects the video information of the area and monitors the wetland water environment through the remote monitoring platform. Sreekantha and Kavya [14] designed a cotton precision irrigation monitoring system based on ZigBee wireless sensor network. The system can monitor cotton growth in real time through ZigBee wireless network technology, enabling staff to remotely grasp cotton growth in the studio and helping staff to manage cotton irrigation scientifically and effectively. Negrete [15] combined drone technology and low-power WSN technology to design a three-tiered farmland WSN structure. The system has good scalability and low power consumption. Compared with static wireless sensor networks, it is more suitable for the farmland environment where there are mostly mountains and hills in the south, and it is difficult to form a large and complete network. Someone proposed a design scheme of a wireless smart meter reading system based on LoRa, and built a long-distance, anticorrosion system based on the LoRa technology of SX1278 which includes a meter reading system with strong interference capability [16]. This scheme has the characteristics of long communication distance, low power consumption, and good real-time performance, and has a wide range of application prospects. Someone also proposed a smart agriculture system based on LoRa technology. The system uses sensors to collect data and transmits the data to the application layer for management analysis through LoRa [17]. The system can remotely monitor and scientifically control the environmental parameters of the planting site. In summary, with the continuous development of Internet of Things technology and wireless communication technology, wireless sensor networks are applied to agricultural production to provide technical support for precision agriculture and smart agriculture from concept to application, and collect crop production environmental information through wireless sensor networks to find problems in a timely and accurate manner, guide agricultural production, improve the quality and production efficiency of agricultural products, and transform the traditional agricultural production model based on manpower to the modern agricultural production model centered on information technology [18–21]. With the continuous emergence of new wireless communication technologies, for example, the LoRa technology in the low-power wide area network field is specifically designed for IoT applications. Compared with traditional wireless communication technologies such as Wi-Fi, ZigBee, and Bluetooth, this technology has ultra-long distances and features such as transmission, low power consumption, low speed, and large coverage area [22–25]. Therefore, applying these new technologies to agricultural production is particularly important for improving the intelligence and informatization of agricultural production [26–29].

3. Construction of a Dynamic Monitoring Model for Cultivated Land Protection Based on the Internet of Things Technology

3.1. Technology Level of the Internet of Things. The Internet of Things technology is a further extension of Internet technology. It refers to the comprehensive connection of people to people, people and things, and things and things with the

Internet through the use of sensors, actuators, identification, and positioning devices according to the agreed agreement to exchange information and communication realizes intelligent positioning, identification, tracking, monitoring, management, and real-time information sharing of human production and life [30–32]. Figure 1 shows the technological level of the Internet of Things.

The Internet of Things should have 4 levels: (1) Perception layer. At the perception layer, various objects form a local network by embedding RFID and infinite sensors and other perception devices to form a local network to obtain information about their own state or surrounding environment, and pass the information into the transmission layer by accessing the network. In some systems, the perception layer can perform some preliminary processing and response based on the collected information. (2) Transport layer. Through the integration of various telecommunication networks (including broadband wireless networks, optical fiber networks, cellular networks, and various private networks) and the Internet, the information of the perception layer is received in real time and accurately, and the information is sent to the processing layer for calculation and processing. (3) Processing layer. Using the resources of the Internet, cloud computing is used to provide functions such as data storage, processing, decision-making, and control to achieve deep interconnection and interaction between global objects. (4) Application layer. We establish various specific applications in different fields such as agriculture, military, and environment.

$$r(n) = \max \{r_i\}, \quad i = 1, 2, \dots, n. \quad (1)$$

The basic layer includes hardware and software platform facilities and cloud platform systems; the platform layer is divided into a data layer and a management layer. The data layer includes various business database resources of land and resources and noninstitutional data pools. The management layer includes government management subplatforms, GIS management subplatform, and rules and model management subplatform; the application layer is mainly a demonstration application platform that includes various types of land business; the user layer is divided into three types of users of land and resources department, government affairs, and society.

$$s(x) = \frac{e^{-x^2}}{\sqrt{2\pi}}, \quad (2)$$

$$f(x, y) = \frac{1}{r \iint (s(x) - x)^2 dx dy}. \quad (3)$$

The model uses virtualization technology to integrate hardware and software resources. J2EE technology provides an easy-to-manage cloud middleware platform and uses service interfaces to interact with users. The flexible host service environment based on pooling, the distributed computing environment based on the Hadoop platform, and the near-master-slave database cluster environment based on the

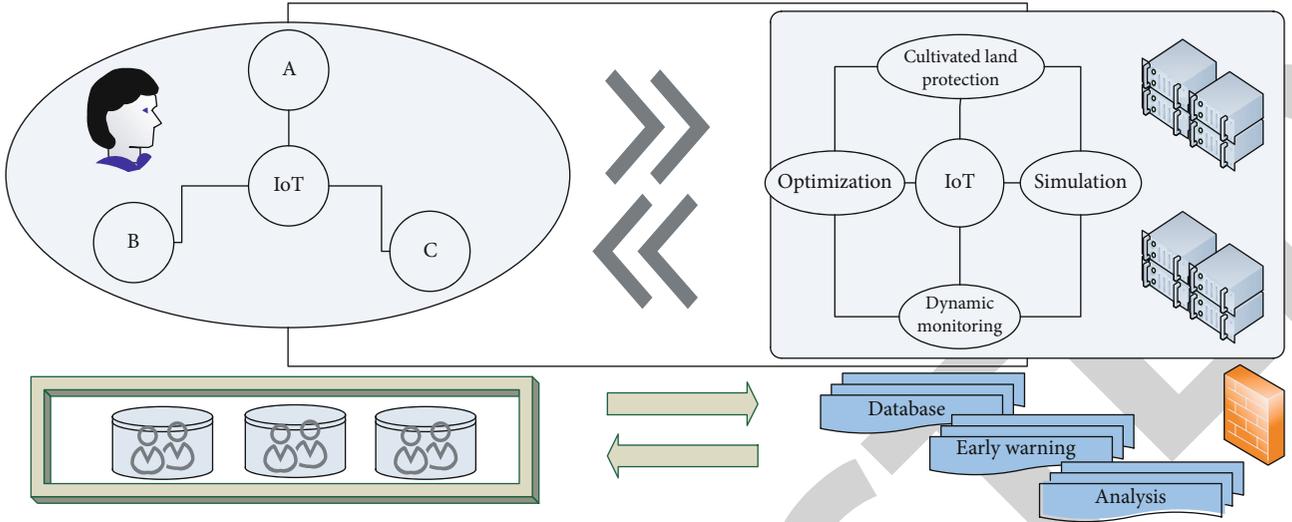


FIGURE 1: Technology level of the Internet of Things.

“database log change monitoring” are used to ensure the operation of the integrated supervision platform.

$$t(i, j) = \begin{bmatrix} r_{11} & \cdots & r_{1j} \\ \cdots & \cdots & \cdots \\ r_{i1} & \cdots & r_{ij} \end{bmatrix}. \quad (4)$$

The software design of the system mainly includes router and coordinator software design. Routers and coordinators, as components in WSN, both have the function of collecting environmental information. The router receives commands forwarded by the coordinator or other routers in real time through the ZigBee module.

$$u(x, y) = \iint \frac{\partial f(x, y)}{\partial x} dx dy, \quad (5)$$

$$v(x, y) = \iint \frac{\partial f(x, y)}{\partial y} dx dy. \quad (6)$$

If the URL in the forwarding command is inconsistent with the network address of the node, it means that the command is sent to other routing nodes, and the command is forwarded; if the URL in the forwarding command is consistent with the network address of the node, it means that the command is consistent with the network address of the node. The command is for this node to analyze the command type; if it is an “addressing” command, send back the network address through ZigBee; if it is the “monitor” command, send back the monitored environment information; if it is the “control” command, send back the control result.

$$h(x) = \begin{cases} x(i) - \bar{x}, & x < 0, \\ x, & x > 0, \end{cases} \quad (7)$$

$$\frac{\partial p(x)}{\partial x} + \frac{\partial p(y)}{\partial y} + \frac{\partial p(z)}{\partial z} = 0. \quad (8)$$

The main task of the coordinator is to establish the network, manage the network, and maintain the network, receive various measurement and control commands from the remote server through GPRS, and compare the network address in the command with the address of the node. If the two are consistent, indicating that the command is from the coordinator, the command is executed, and the execution result is sent to other routing nodes, the command is forwarded through ZigBee, and the liquid crystal display of the coordinator will display the execution result of these control commands. The system control center includes MCU, LCD liquid crystal display circuit, debugging circuit, and Wi-Fi module circuit design. The circuit design and software workflow of the ZigBee coordinator are as above. The ZigBee coordinator is connected to the pins of the processor through pins, respectively, and the coordinator module transmits the soil environmental parameter information collected from the terminal node through the ad hoc network to the control center module through serial communication after programmed processing.

3.2. Dynamic Monitoring Algorithm for Cultivated Land Protection. (1) In the dynamic monitoring function, it is a real-time collection of data such as the location of monitoring points, soil physical properties, nutrients, and environmental quality parameters through sensor equipment; the data are transmitted to the service management platform through the mobile communication network, and the service management platform uses cloud computing to analyze the data and deal with the changes in the quantity and quality of cultivated land in time. (2) In the automatic warning function, on the service management platform, cloud modeling is used to set thresholds for the quantity and quality of cultivated land soil. When the threshold is exceeded, the management department or farmers will be reminded by mobile phone text messages.

$$y(x) = \text{median}[f(s, t)], \quad (s, t) \in N(x, y), \quad (9)$$

$$k(x+1, y+1) \cdot u(x+1, y+1) + k(x, y) \cdot v(x, y) \leq R^2. \quad (10)$$

(3) In the support decision-making function, according to the decision-making needs, the management department can use cloud modeling to analyze, sort, and dig the in-depth massive soil data uploaded by the sensor, obtain the required information, and provide data support for the later policy formulation and implementation. (4) In the remote guidance function, an expert guidance system is set up to provide farmers with scientific guidance on fertilization and planting based on the analysis results of cloud computing, so as to realize remote diagnosis and medical treatment of cultivated land quality management. (5) In the self-service query function, farmers log in to query soil data and expert system suggestions through computers or mobile phones, so as to achieve scientific planting and fertilization, and to achieve early detection and early resolution of problems through real-time updates of data. (6) In the posttracing function, after the occurrence of agricultural product quality and safety issues, relevant departments and consumers can inquire about the origin and soil information of agricultural products through the electronic touch screen and mobile phones with barcode recognition system, so that the origin is recorded, the information can be inquired, and the quality can be checked.

Through the application of Internet of Things technology such as wireless sensors and network communication, the core demonstration field ocean environment soil temperature and humidity, air temperature and humidity, light intensity, CO₂ concentration, and other main data are dynamically monitored and data returned. The operability of the system includes the initialization of the control center, which is mainly to initialize the hardware resources of the processor, including the IO and timer used in the system. After the system initialization is completed, send the AT command to the Wi-Fi module and configure the Wi-Fi to connect to Android via the Internet. In smart terminal, if the connection is not successful, check whether the Android terminal device has opened the TCP/IP service and port number, and then let the Wi-Fi module connect. Applying GPRS and ZigBee network transmission technology to realize remote real-time transmission of environmental data, historical data can be queried through the system in order to achieve data sharing, provide a technical basis for future IoT monitoring and research in environment, and improve cultivated land scientific data. The coordinator gateway is mainly composed of ARM microcontroller platform, Ethernet module, ZigBee coordinator module, 3G module, and power supply module. Its function is to send the data collected by the sensing node to the farmland monitoring and management system. The flow of the farmland protection dynamic monitoring algorithm is shown in Figure 2. The power module is responsible for providing energy for the entire node, the Ethernet module converts the signal transmitted on the network into data that can be recognized by the ARM motherboard, and the 3G

module is responsible for the interaction of various control commands and the transmission of perception data. The ZigBee coordinator module completes wireless communication applications with low power consumption.

3.3. Optimization of Model Parameter Factors. The processing flow of big data mainly includes data collection, data preprocessing, data storage, data processing, data analysis, and data visualization. For data obtained from different data sources, due to their different structures, special methods are used to process these data to convert them into a unified data form, and then, use appropriate data analysis methods to centrally process and visualize the results. The key technologies used in the core data processing and analysis process are divided into cloud computing, parallel computing, distributed file system, distributed parallel database, open source implementation platform Hadoop, and visualization technology. A large-scale storage cluster is built on a cheap PC server, and HBase technology is used to solve the data management problems of different structures in the land resources. It is also possible to use virtualization technology in cloud computing to virtualize various resources into resource pools to realize unified data analysis and processing.

The goal of cleaning and integrating land and resources big data is to use reasonable methods to process various structures and types of land and resources data or information and form usable databases and data sets. First, we perform data extraction and extract the data that needs to be analyzed and processed from the data source. Figure 3 shows the distribution curve of IoT data packets. Second, “clean” all the collected data that are not valuable and unnecessary, that is, by designing some filters, filtering out, and filtering out the useless data, and different information need to develop different cleaning plans. Finally, to integrate multisource information, in addition to unifying data of different types of structures, it is also necessary to consider the instability caused by data differences caused by factors such as geography, time, and space, and then support the analysis and management of land and resources data. After the system is successfully connected, the initial configuration of the ZigBee coordinator can be carried out. After the ZigBee coordinator successfully builds the network, it can receive the data information sent from the ZigBee terminal device. The cleaned and integrated data can be better stored, managed, and applied to subsequent analysis and decision-making.

4. Application and Analysis of Farmland Protection Dynamic Monitoring Model Based on Internet of Things Technology

4.1. IoT Data Preprocessing. This research mainly measures the theoretical ecological potential of cultivated land improvement and uses the relevant data of land use status and change survey and the latest land resource survey to calculate the area of cultivated land to be improved. Specifically, the total cultivated land area in the land use change survey of the administrative unit is measured on remediation scale. Figure 4 shows the architecture of the dynamic monitoring

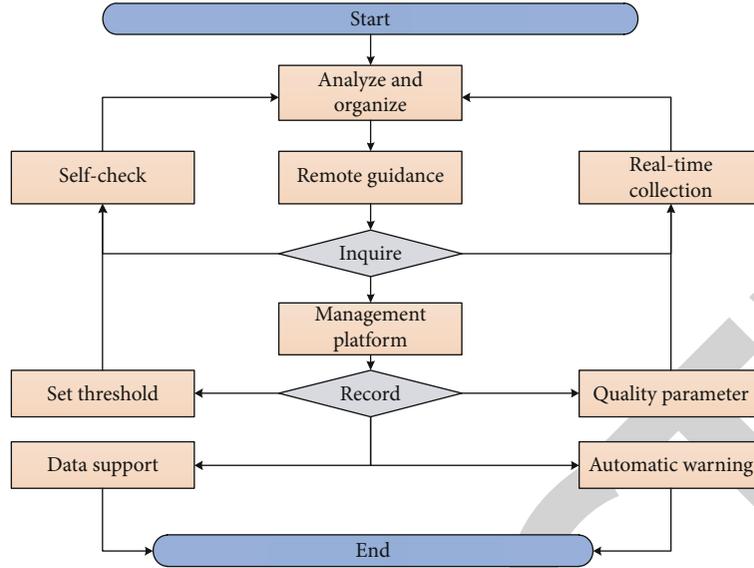


FIGURE 2: The flow of the dynamic monitoring algorithm for cultivated land protection.

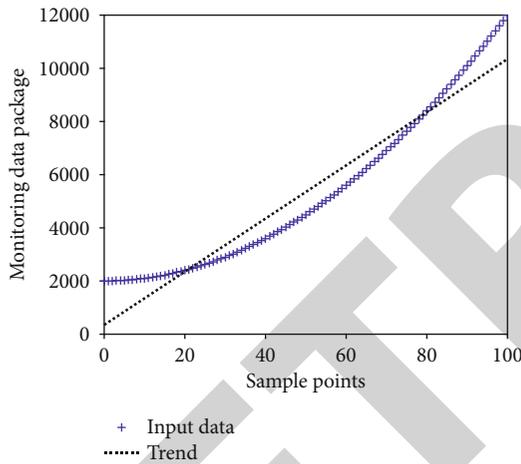


FIGURE 3: Data packet distribution curve of the Internet of Things.

model for farmland protection based on the Internet of Things technology.

Based on the classic results of current farmland protection dynamic monitoring research, this research uses the weight evaluation factors of different farmland ecosystems as references to develop an Internet of Things system including perception, transmission, and application and builds an information platform for data display and control management, and a simulation experiment was carried out. This result is based on the average production of cultivated land at the average level. Due to the large regional differences in cultivated land, this study revised the monitoring and control strategies of cultivated land ecosystem services on the time scale and spatial scale based on the results. According to the average market value of cultivated land resource output in the statistical yearbook, an equivalent factor is determined to complete the evaluation of the dynamic protection and monitoring efficiency of the national cultivated land ecosystem.

In spatial correction, the size of the deviation of the cultivated land system function monitoring data is closely related to environmental factors. Generally speaking, the greater the environmental factor is, the better the statistical results of the deviation of the cultivated land system monitoring data is. Therefore, the deviation of the monitoring data of cultivated land system function in different regions will also change with the changes of environmental factors. The study uses net primary productivity (NPP) to represent environmental factors and uses NPP for spatial correction. The monitoring efficiency of the farmland protection system service is revised from the average level to each district and county, so that each district and county has a benchmark value for the detection efficiency of the farmland protection system, and the regional difference coefficient is used to reflect this difference. NPP and the land use data that correct the service value of the cultivated land protection system come from the database of the Resource and Environmental Science Data Center of the Chinese Academy of Sciences. Figure 5 shows the statistical deviation curve of the cultivated land environmental scientific data. According to 20 years of national NPP data, the ecosystem and NPP are superimposed together, and the average NPP of the cultivated land ecosystem in each region and its error range are calculated according to the national data, so as to spatially correct the cultivated land protection in each region for the monitoring efficiency of the system.

4.2. Cultivated Land Detection Model Simulation. The development of soil proximity sensor research provides the possibility for the automatic and rapid acquisition of soil information. In recent years, with the rapid development of modern sensor technology and the rise of the Internet of Things industry, research and development of various sensors that quickly obtain information about objects and surrounding environments has become a hot spot. The control center coordinator receives the data information collected by the ZigBee network through the interrupt processing

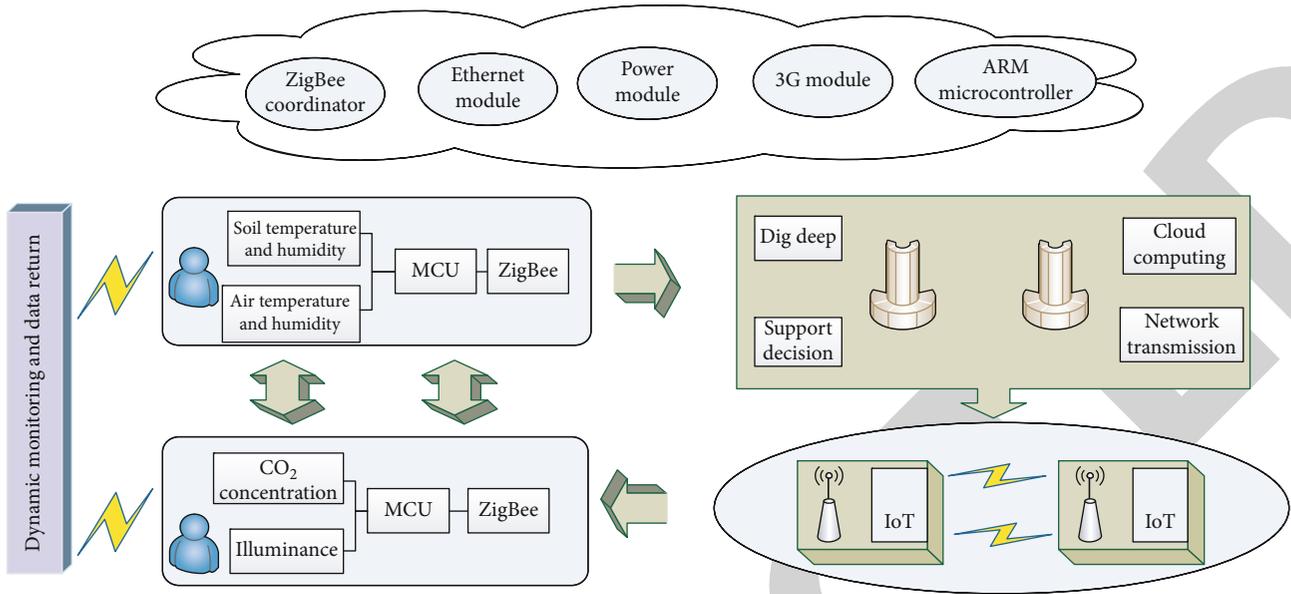


FIGURE 4: The architecture of the dynamic monitoring model for cultivated land protection based on the Internet of Things technology.

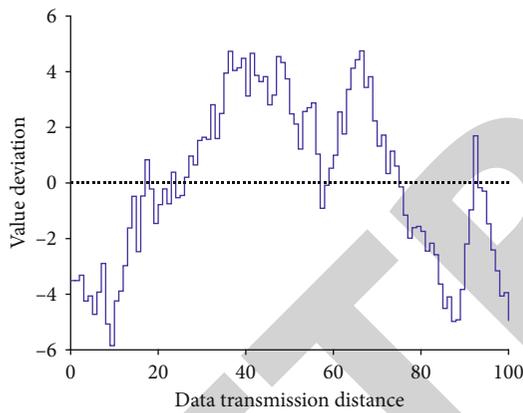


FIGURE 5: Statistical deviation curve of cultivated land environmental scientific data.

function of the serial port, performs data preprocessing, and then sends it to the Android terminal device via Wi-Fi. You can view the multiple sensor data information of each node of the terminal on the Android terminal device. In this study, the quality potential of cultivated land remediation is calculated based on the highest grade of agricultural land in the three-level index area where the cultivated land is located as the level that the cultivated land can reach after the cultivated land is renovated in the three-level index area where the county is located. The gap between the highest utilization level of the county and the county utilization level is the potential for improvement of the cultivated land level. After logging in to the cultivated land quality improvement information sharing platform, you can click on the auxiliary monitoring module and select the city or county to query the cultivated land environmental data of the relevant monitoring site. The acquired remote real-time data are refreshed in units of hours, and the operating conditions of the sensors at each monitoring point can be queried at any time. Users

can query the real-time air temperature and humidity, soil temperature and humidity, light, and other environmental data obtained by the site by selecting the monitoring point. They can also query historical data by selecting the start and end time of the query, and they can also select minutes, hours, days, months, to view the dynamic curve changes of each environmental data in any of the five display methods.

The quality of the cultivated land has been improved after renovation. At the same time, the cultivated land is concentrated and contiguous, with high and stable yields, good ecology, and strong disaster resistance. The improvement of the quality of cultivated land will inevitably affect the ecological functions of cultivated land. The higher the quality of cultivated land is, the greater the ecosystem service functions and the corresponding increase in the value of ecosystem services are. Figure 6 shows the curve plot of the evaluation scores of cultivated land indicators. In agricultural land grading, the quality of cultivated land is used to measure the quality of cultivated land. Increasing the grade of cultivated land will definitely improve the ecosystem service capacity and value score of cultivated land. Through the analysis and selection of the main influencing factors of cultivated land quality, the establishment of standards, division of intervals, and five levels of nonalert, light alert, medium alert, heavy alert, and large alert are set. The data and values correspond to the corresponding levels. When the cultivated land quality information is obtained and an alarm occurs, a forecast will be made, and the record will be processed. Cultivated land quality early warning is established through the establishment of standards, continuously setting up monitoring tasks, the system automatically distinguishes abnormal data areas, extracts abnormal area data information, locates areas, and provides early warnings. The specific indicators are set up as shown in the figure.

Figure 7 shows the histogram of the data packet capacity of the arable land of the Internet of Things. In the test procedure, during the test, send 10 bytes of information to index

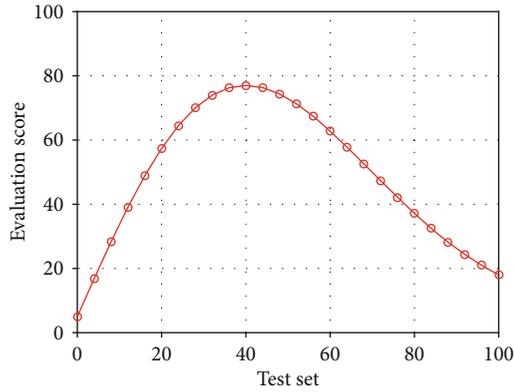


FIGURE 6: Curve diagram of evaluation scores of cultivated land indicators.

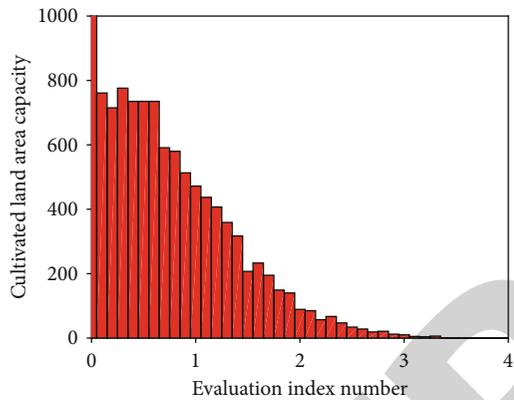


FIGURE 7: Histogram of data packet capacity of cultivated land in the Internet of Things.

number A through index number B, with index number B as the transmitting end and index number A as the receiving end. Index number A is connected to the computer through the serial port, and the PC side uses the serial port debugging assistant to receive and count data. The physical connection of index number A and index number B is shown in the paper. In the experiment, the transmission efficiency is used to express the ratio between the actual number of received data packets and the transmitted data packets. Based on the above analysis, there is a positive correlation between the level of cultivated land, yield, and ecosystem service value. Therefore, the baseline value of ecosystem services after cultivated land consolidation is calculated based on the degree of improvement of cultivated land grade. The ecological service value of cultivated land after renovation has two sources. On the one hand, the quality of the original cultivated land is improved, and the value of cultivated land ecosystem services is increased. On the other hand, the value of ecosystem services generated by the newly added cultivated land is taken into account. The quality will not reach the best farming status and quality, and its ecosystem service value is calculated by multiplying the benchmark value of cultivated land before improvement and the area of newly added cultivated land. Based on this, the total value of cultivated land ecosystem services after improvement is calculated.

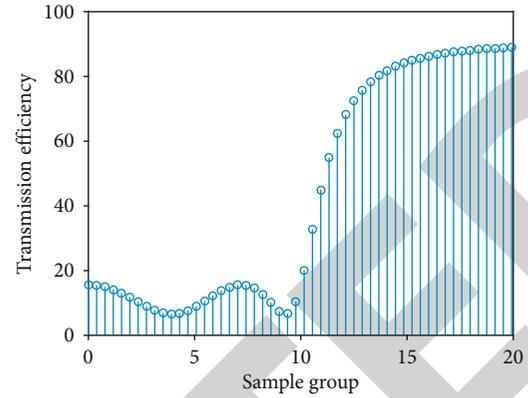


FIGURE 8: Trend of real-time monitoring data transmission efficiency of farmland under the Internet of Things.

4.3. Example Application and Analysis. The monitoring management system is built on the cultivated land quality improvement information sharing platform. It uses Visual Studio 2013 as a development tool and uses Baidu Map API technology to build a map application publishing server for the map display of 10 monitoring points. Since the completion of the construction in 2019, it has been in operation for a period of time, and a large amount of real-time monitoring data has been obtained at the same time. The router and the coordinator, as component nodes in the WSN, both have the function of collecting system operability environment information. The router receives the commands forwarded by the coordinator or other routers in real time through the ZigBee module. We collect real-time data such as the location of monitoring points, soil physical properties, nutrients, and environmental quality parameters through sensor equipment and transmit the data to the service management platform through the mobile communication network, and the service management platform uses cloud computing to analyze and process the data and grasp the cultivated soil in time changes in quantity and quality.

According to the control strategy requirements of the greenhouse environment control equipment, indoor collection includes air temperature, humidity, solar radiation intensity, 10 cm substrate temperature, and 10 cm substrate moisture content and outdoor collection includes air temperature, humidity, solar radiation intensity, wind speed, and total 9 environmental parameters. Figure 8 shows the real-time monitoring data transmission efficiency trend of cultivated land under the Internet of Things. In the selection of sensors, according to the requirements of the equipment in the greenhouse production process, that is to adapt to the harsh production environment such as high temperature and high humidity, and its data transmission accuracy, accuracy, stability, consistency, and other performance parameters can meet the use. The project follows the corresponding sensor, as shown in the particle, using its timing sensing data. The information processing platform plays two major functions: the collection and display of indoor and outdoor environmental parameters and the control of environmental control equipment. In terms of data display, 9 environmental parameters collected in the greenhouse

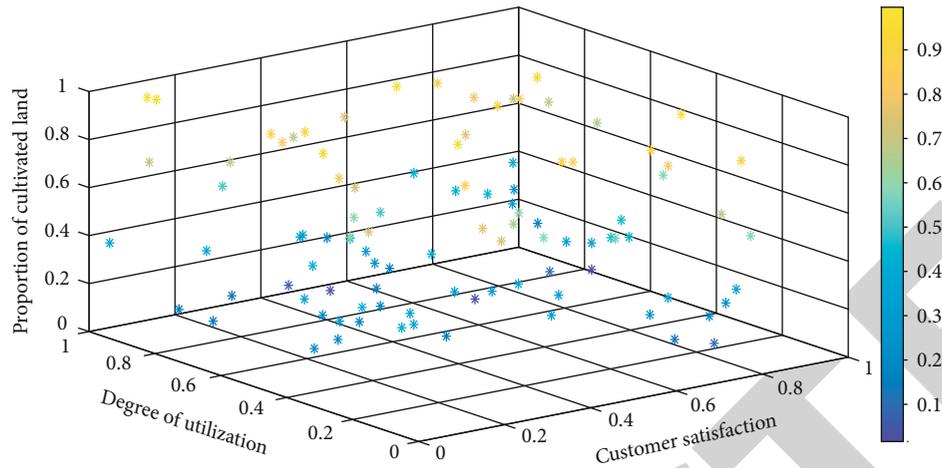


FIGURE 9: Three-dimensional scatter point distribution diagram of indicator factors of the cultivated land protection monitoring system.

can be displayed in real time, and historical data of more than 3 years can also be stored. In terms of control decision-making, the collected data can be substituted into the control modes of equipment such as external insulation, internal insulation, and top ventilation to make judgments and decisions on the next action, and send action indicators to the equipment.

Cultivated land protection is a systematic and comprehensive land development and management process. The design of the evaluation index system of the dynamic monitoring system for cultivated land protection should be comprehensively measured and considered to construct a comprehensive and systematic index system to reflect the current situation of cultivated land protection as objectively and accurately as possible. Figure 9 shows the three-dimensional scatter point distribution map of the indicator factors of the cultivated land protection monitoring system. Therefore, four factor layers were established (utilization structure, input benefit, utilization degree, and utilization benefit), and then, we selected the proportion of construction land, the proportion of cultivated land, the level of soil fertility, the level of land productivity, the level of soil pollution, the number of satisfied users, the total number of users, and the public number of participants, the rate of government suggestions adopted, the structure of land use, the rate of food safety, and the rate of pollution treatment as 12 evaluation indicators.

According to the baseline value of ecosystem services and the cultivated land area of each county before the remediation, the error statistics of the total value of the cultivated land ecosystem services of the county before the remediation are obtained. Figure 10 shows the statistical distribution of error bars for different sample points of the model. The construction of the dynamic monitoring system for cultivated land protection is calculated and evaluated by the selected indicators. Four levels of error indicators are planned to be set: 0.01-0.29 is the basic nonoperational state, 0.3-0.49 is operable but not ideal, 0.5-0.7 is normal operation, and 0.8-1 is ideal. According to the error evaluation results, corresponding levels are set to explore the dynamic monitoring system of cultivated land protection. At the same time, according to the value of the error index, we look for the sys-

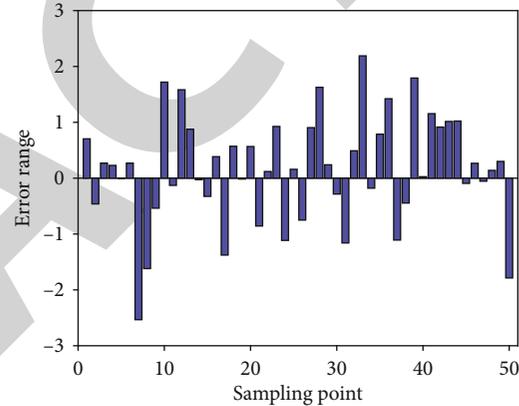


FIGURE 10: Error histogram statistical distribution of different sample points of the model.

tem's deficiencies and the problems that need to be solved in the protection of farmland.

5. Conclusion

The farmland protection dynamic monitoring system platform based on the Internet of Things technology is based on farmland protection big data and data management platform, and relies on the land and resources e-government platform, comprehensive information supervision platform, and information service platform to realize various business monitoring and supervision functions of farmland protection. This subject uses a variety of sensors, two wireless sensor networks, and Android technology to design and implement a soil multiparameter collection and transmission system based on the Internet of Things technology, which is mainly used for monitoring important parameters of agricultural soil and guiding farmers to scientifically and rationally fertilize and manage farmland. Gradually, it can increase crop yields while protecting the fertility of arable land. This paper analyzes the development of the smart farmland management platform from the perspectives of the construction ideas, overall framework, and functions of the smart

farmland management platform, and provides a reference for the development of the smart farmland management platform. The innovation of this paper is to use wireless technology to build an actual test environment, build a system that integrates collection, transmission, feedback, and optimization, and conduct joint testing with Android mobile terminals. Applying the Internet of Things technology to the protection of cultivated land quality, on the one hand, it can realize the automation of soil information acquisition; on the other hand, it can efficiently and quickly process the massive soil data uploaded to obtain valuable information from it, and then improve the quality of cultivated land with protection providing intelligent decision-making.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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