Hindawi
Scientific Programming
Volume 2023, Article ID 9820345, 1 page
https://doi.org/10.1155/2023/9820345

Retraction

Retracted: Environmental Monitoring and Restoration of Ecological Cycle Index System Based on IoT Agriculture

Scientific Programming

Received 1 August 2023; Accepted 1 August 2023; Published 2 August 2023

Copyright © 2023 Scientific Programming. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1].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] A. Hou, "Environmental Monitoring and Restoration of Ecological Cycle Index System Based on IoT Agriculture," *Scientific Programming*, vol. 2022, Article ID 9084321, 13 pages, 2022.

Hindawi
Scientific Programming
Volume 2022, Article ID 9084321, 13 pages
https://doi.org/10.1155/2022/9084321

Research Article

Environmental Monitoring and Restoration of Ecological Cycle Index System Based on IoT Agriculture

Aixia Hou

School of Artificial Intelligence, Chongqing Creation Vocational College, Yongchuan 402160, Chongqing, China

Correspondence should be addressed to Aixia Hou; 15040920619@xs.hnit.edu.cn

Received 5 July 2022; Revised 19 August 2022; Accepted 3 September 2022; Published 22 September 2022

Academic Editor: M. A. Rashid Sarkar

Copyright © 2022 Aixia Hou. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Environmental factors have a direct impact on the development of agriculture, so it is particularly important to detect the environment of the agroecological cycle index system. Although there are some plans for environmental monitoring, most of them are environmental monitoring for a larger concept, but this study is specific to the actual object. This article takes farmland as the research object and comprehensively uses embedded technology, information monitoring technology, and network technology based on the analysis of the research status and system application of the farmland environmental monitoring system. This article studies and designs a real-time online remote monitoring system for farmland ecological environment based on embedded architecture and GPRS technology. By using sensors to obtain farmland information, it is displayed on the monitoring center and mobile client, and data information is obtained in real time. It manages and protects the farmland environment in advance. This article measures and analyzes the data from the final experiment. The experimental results show that the monitoring system can accurately collect farmland data in real time. And through the embedded server and the Internet, the data can be remotely transmitted in real time and displayed on the monitoring center and mobile client software. The results showed that PM2.5 was 30 $\mu g/m^3$ at 20:00. The experimental data have the characteristics of real time and stability, which can meet the requirements of real-time network remote monitoring and transmission of data.

RETRACTED

1. Introduction

With the continuous development of agricultural technology, the monitoring of the farmland environment has also begun to be limited to unilateral monitoring in all aspects of monitoring. There are also an increasing number of targets, which include not only unilateral information factors but also monitoring of multiple factors that have an impact on the environment. The monitoring of farmland ecological environment not only monitors its composition and concentration but also provides data support for the management and protection of farmland in the future. In this way, we can comprehensively and accurately elucidate the condition of the farmland environment so as to make an accurate assessment of the farmland quality. The purpose of monitoring the farmland environment is to better manage and protect the environment through feedback information, so as to achieve the effects of early detection, early prevention, and early treatment. Environmental protection is the use of modern advanced technical means, proceeding from reality, while rationally using the resources provided by nature, to protect nature from damage and to achieve sustainable development. This not only makes farmland management easier, but is also very important for human health.

In order to meet the demand for environmental monitoring of farmland ecological cycle index system, this article designs a real-time online remote monitoring system for farmland ecological environment through the combination of software and hardware. The hardware system is controlled by the S3C2440 processor with powerful computing power, and the network data transmission is realized through the GPRS module. As the most important step, data acquisition is completed by a multisensor, and a multidata fusion algorithm is used to process the data. The final system can realize real-time monitoring of the environment. This article analyzes and summarizes the research results at home and abroad by consulting a large number of literatures. Based on drawing and optimizing the existing monitoring system viewpoints, this article proposes its design scheme. The experimental results show that the scheme is feasible and can realize data collection and display. In this paper, the remote monitoring of farmlands is realized by using embedded and network technology, and preliminary results are obtained. It plays an important role in the monitoring of the farmland environment.

2. Related Works

Many scholars have provided a lot of references for research on IoT agriculture, ecological cycle, indicator system, and environmental monitoring.

Ekstrom used Monte Carlo simulations to compare the performance of standard logistic regression models with two approaches for modeling correlated binary responses and cluster-specific and population-averaged logistic regression models [1].

Magdalena validated the application of the Atmospheric Purity Index method in the assessment of environmental pollution and the assessment of general ecological conditions in protected montane forests in Gorce National Park (West Carpathians, Poland) based on the associated epiphytic lichen biota [2].

Darrah et al. tested the value of the Wetland Extent Trend (WET) index as an updatable indicator of wetland area trends and its use in global and regional scale assessments and national reporting. They expanded this indicator to include regional trends in Latin America and the Caribbean as well as the global man-made WET index [3].

Rybak and Ryabichina aimed to develop and test hardware and software systems for real-time monitoring of atmospheric air conditions. They presented the results of the creation and use of an automated system for monitoring atmospheric air using pollutant transfer modeling [4].

Pohrebennyk et al. determined the parameters of soil heavy metal pollution through experiments. Taking Rozdil SMCE "Sirka" as an example, they demonstrated the main problems of monitoring systems on the territory of mining and chemical enterprises during the liquidation phase. They also assessed the impact of mining and chemical companies on environmental pollution status (soil, water environment, and waste management status) [5].

Krasovskyi et al. explored the development of modern information technology to identify the location and consequences of amber production in western Siberia based on satellite environmental monitoring methods and GIS tools [6].

Myrontsov and Okhariev proposed a method to integrate human impact and environmental status data into decision information support systems in the fields of environmental management and regional environmental security [7].

Chen and Yan studied the environmental ecological evaluation based on the copula function and the environmental evaluation index system of the independent innovation ability of the environmental bio-industrial cluster. At the same time, they took the Wuhan Optics Valley Biological Lake Environmental Bio-industry Cluster as the investigation object and conducted a relevant test on the evaluation system of the independent innovation capability of the bio-industrial cluster [8].

Duan et al. used Emergy Accounting (EA) and Life Cycle Assessment (LCA) methods to investigate the environment, capital investment, and ecosystem services of a typical urban wetland park in Beijing Green Lake Urban Wetland Park (GLUWP) [9].

The data of these studies are not comprehensive, and the results of the studies are still open to question, so they cannot be recognized by the public and thus cannot be popularized and applied.

3. Environmental Monitoring and Restoration System

In the selection of the implementation scheme of the farmland environment remote monitoring system, based on the application requirements of low cost, low power consumption, and good real-time performance, a set of schemes with high practicability and feasibility have been designed. It proposes a design scheme of a remote monitoring system for the farmland environment based on mobile Internet technology. This experiment comprehensively considered various factors, designed the overall structure of the system according to the actual needs, and briefly explained the overall design [10, 11].

In the design of the system, considering that there are many uncertain factors in the farmland environment, the design of the overall scheme of the system first considers that the system must adapt to the harsh environment. In addition, the value of information lies in real time, and the acquisition of environmental information must be in real time in order to reflect the purpose of environmental monitoring [12, 13]. According to the experimental requirements, the functions of the monitoring system should include the following aspects:

(1) The system should have the function of remote monitoring [14].

(2) The development cost of the system must be low, and it should have expansion modules [15]. The development of embedded systems has a short data collecting period, is low in cost, and is simple to expand on the input and output interfaces [16].

(3) The volume should not be too large, should be easy to install and uninstall, and can adapt to different conditions. Embedded systems are small, portable, and very convenient to carry and use [17, 18].

(4) The performance must be stable and able to adapt to continuous work for a long time [19]. With the continuous updating of the system, the functions of the embedded system are constantly becoming stronger and the system performance is continuously enhanced [20].

RETRACTED

(5) It can realize human-computer interaction [21, 22].

This system adopts an S3C2440 microprocessor to transplant Linux as an ideal design scheme, supplemented by peripheral circuits and various sensors to form a hardware platform. It builds a wireless network to realize real-time online acquisition, wireless remote monitoring, and real-time display of mobile client software [23].

According to the experimental requirements, the overall structure of the system is shown in Figure 1. The system consists of sensor elements (SO_2 sensor, CO sensor, PM2.5 sensor, NO_2 sensor, UV sensor, etc.), embedded microprocessor, GPRS module, remote computer, mobile client software, and peripheral circuits. Several of the sensors are responsible for collecting data, and the embedded server is the control center of the entire system and plays a role in coordinated control. Through the GPRS network, the collected data are transmitted to the monitoring center and the mobile client to realize an online display [24]. Remote monitoring adopts the "B/S" mode in the implementation mode, and the mobile phone client software can be opened to monitor the environmental conditions of the field crops in real time [25]. B/S mode refers to the technology and architecture of accessing the web server and the background database through the HTTP transmission protocol on the TCP/IP protocol.

The hardware configuration determines the quality of the system. The basic block diagram of the hardware system is shown in Figure 2. The system chooses the system platform from factors such as power consumption, scalability, stability, and compatibility. The entire farmland monitoring system consists of the lower computer microprocessor, various sensors, and the upper computer mobile client. The lower computer is mainly composed of microprocessor S3C2440, CO sensor, NO_2 sensor, ultraviolet radiation sensor, SO_2 sensor, PM2.5 sensor, and GPRS communication module.

3.1. Sensor. The sensor module is the foundation of the entire design and the source of data [24]. A good sensor can obtain accurate data information, so the requirements for this module must be very strict, the data obtained must be accurate, and the work must be stable. The common characteristics of the sensor in this article are high measurement accuracy, stable operation, strong anti-interference ability, and long-term operation.

3.2. Serial Communication Module. The serial port of the board selected in this article is connected to the wireless receiving module for data transmission. The serial port is the main interface for data output and a necessary means of communication. The experiment uses the MAX3232C chip as the serial port module. The function of this chip is to perform level conversion on the circuit.

3.3. Microcontroller. This text adopts the S3C2440 microcontroller as the development platform of hardware. The processor has very good stability, and it also has a wealth of hardware interfaces. There are many operating systems supported, with the advantages of low power consumption, strong processing power, and good stability.

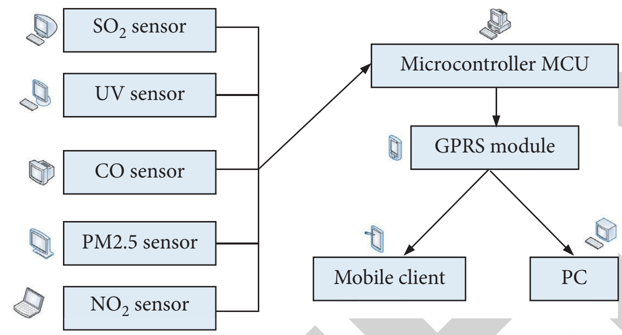


Figure 1: Environmental monitoring system block diagram.

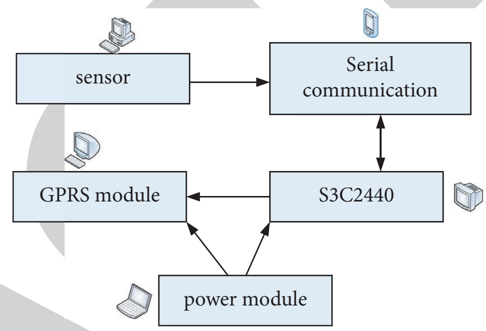


Figure 2: Hardware system structure diagram.

3.4. Wireless Communication Module. The wireless communication module is the network support of the system and provides a guarantee for the normal transmission and reception of data. The wireless communication module has the advantages of low cost, low power consumption, simplicity, and convenience and can be connected automatically once the line is dropped. The schematic diagram of its transmission mode is shown in Figure 3.

The design of the system software scheme is composed of mutual coordination among various parts, and commands are issued through the control center. The composition of the software system mainly consists of the following parts:

3.4.1. Software Design of Sensor Nodes. The writing of the sensor data acquisition program adopts cross-compilation, that is, it is written on the Keil software and then programmed into the sensor. The programming language used is C.

3.4.2. Software Design of the Data Transceiver Module. This module mainly performs programming for data transceiver and serial communication. Among them, the software programming of the data receiving module is implemented in C language. The procedures for sending and receiving are the same, and only the configuration

RETRACTED

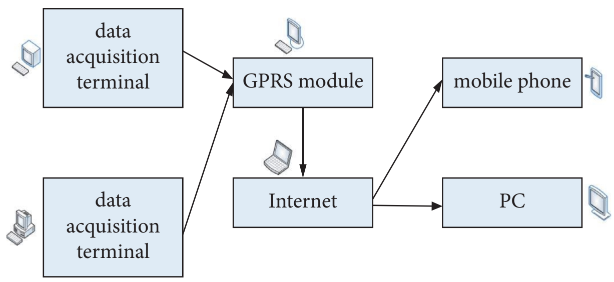


Figure 3: Schematic diagram of the transmission method.

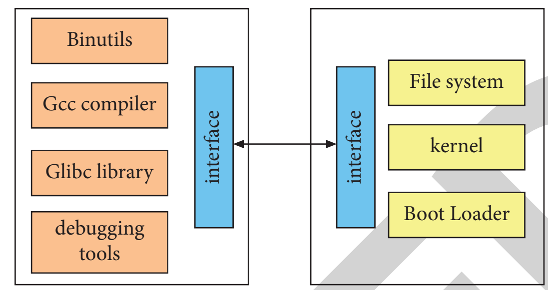


Figure 4: Embedded cross-compilation environment block diagram.

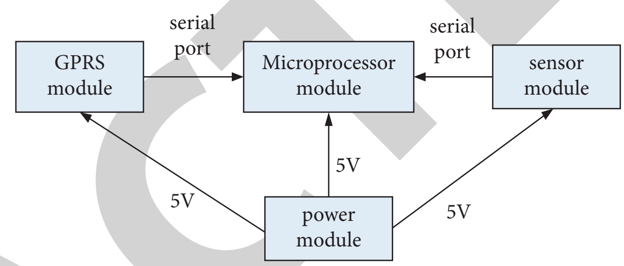


Figure 5: Hardware block diagram.

corresponding to the register needs to be changed during programming [25].

3.4.3. Software Design of the Network Communication Module. The communication module is equivalent to the porter of the system, which transmits the data from the node to the interface of the host computer. The quality of the communication module determines whether data are lost during transmission, and its transmission protocol is TCP/IP. This protocol is a commonly used communication protocol for computers, and it is only necessary to program the interface when using it [26, 27].

3.4.4. Design of Remote Monitoring Software. The remote monitoring system is displayed in the form of mobile client software. Client users use mobile phones to connect to the GPRS network to log in to the client software for browsing, and then real-time monitoring of environmental data collection can be achieved [28].

The realization of the hardware platform is based on the software environment. The operating system is the core part of the whole system, which governs and controls all the parts in the system, makes them cooperate to complete the task, and provides a good development environment for the application program [29]. Therefore, the operating system becomes important throughout the development platform.

The Linux system is different from other operating systems because its source code is completely open to the outside world. This is something no other operating system can do, and with its powerful features, it can run on multiple hardware structures.

The premise of embedded program development is cross-compilation. The same experiment also uses this principle—first writing the program on other software and then burning it into the target board. This article adopts the installation of the Red Hat Linux system on a PC, which is a commonly used virtual device for embedded cross-compilation; the target machine is the embedded platform. Figure 4 shows the establishment of the cross-compilation environment.

According to the specific analysis of the system and the statistics of the monitoring scale of the designed control system and the determination of the functional requirements, the hardware selection and design of the control system can be carried out. At the same time, based on ensuring system functions, good cost performance is also a design consideration. For the whole system, the hardware design is equivalent to the skeleton, and the software system is equivalent to the blood. Only when the two complement each other can the normal walking of the human body be formed. Therefore, the hardware system is the foundation, which supports the basic framework of the entire system and plays a crucial role in the operation of the system. The modules of the system cooperate to complete the task together. The hardware of the system is mainly composed of the following aspects, and the connection diagram is shown in Figure 5. The hardware of the system consists of a processor module, a power supply module, a sensor module, and a GPRS module.

The core used by S3C2440 has many advantages, such as low power consumption, fast processing speed, stability, and reliability. It has its own 16KB instruction Cache and 16KB data Cache. S3C2440 provides three universal asynchronous serial ports for data transmission and reception. Figure 6 is the connection relationship between the hardware modules of the system.

In the S3C2440 processor, the main frequency of the central processing unit CPU is 400MHZ. The external memory is 64M bytes; there are five USB interfaces in total, including four USB1.1HOST interfaces and one USB1.1Device interface; a reset button with a dedicated reset button, which is relatively stable; 5 V power supply is used for power supply. To verify the analog-to-digital conversion, an adjustable resistor is added. Therefore, the processor can meet the design needs.

As the data acquisition terminal in the lower computer, the sensor is the key part of the system. All the work of the system is for it. The sensor is the first link to obtain

RETRACTED

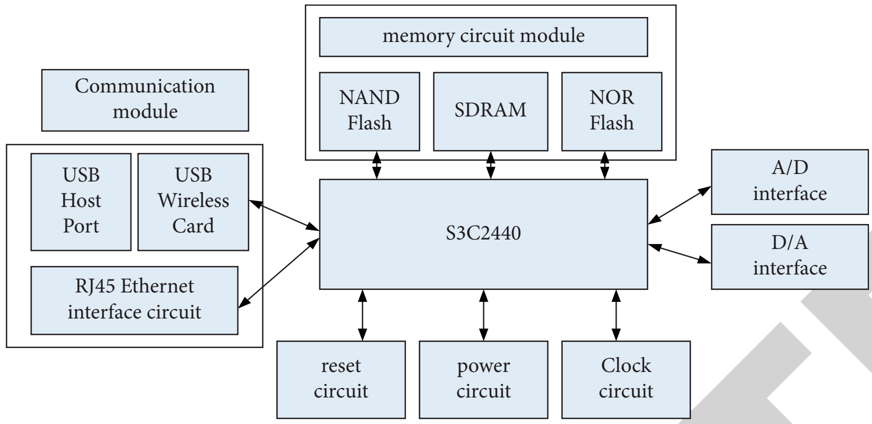


Figure 6: Hardware platform structure.

Table 1: Performance specifications of the SO_2 sensors.

Serial number	Parameter	Size	Unit
1	Test range	0–20	ppm
2	Response time	≤20	s
3	Operating voltage	0–5	V
4	Temperature range	−20~50	°C

Table 2: Performance metrics of the UV sensors.

Serial number	Parameter	Size	Unit
1	Spectral range	240~370	nm
2	Accuracy	±3%	rdg
3	Range	0–200	w/m^2
4	Operating temperature	−10~60	°C

information resources, and the measurement accuracy of the sensor also determines the accuracy of the system data. So, sensor selection is very necessary. In this article, according to the needs of the experiment, considering various factors, the most suitable sensor is selected for the experiment.

Sulfur dioxide is one of the most serious pollutants in air emissions and one of the indicators of air pollution measurement. The entry of sulfur dioxide into the respiratory tract can cause various respiratory diseases, and after entering the blood, sulfur dioxide can destroy the decomposition enzymes in the human body, which will have a great impact on the human internal organs. Table 1 is the performance index of the SO_2 sensor.

The working principle of the SO_2 sensor: The principle used is a redox reaction. SO_2 gas enters the surface of the sensor electrode and reacts with the electrolyte in the sensor to generate an electrical signal. In this process, the air inlet only requires a small amount of gas to enter the sensor, and the reason for entering a small amount of gas is to make it respond more fully and generate a small amount of current. Adding a medium to the sensor can speed up the response. The formed current will flow between the two poles; and as long as the magnitude of the current is measured, the concentration of the gas can be judged.

A small amount of ultraviolet radiation on the human body, in addition to having a bactericidal effect, can also enhance immunity and promote the production of vitamin D. It has many benefits for human health. In order to accurately measure ultraviolet data, this article selects the ZWX-R4 ultraviolet sensor, which has the advantages of high measurement accuracy, good stability, and strong anti-interference ability. The technical parameters of the UV sensor are shown in Table 2.

The working principle of the ultraviolet sensor is that when a voltage is applied to both sides of the sensor, there is light irradiation and the electron emission device on the negative electrode will generate photoelectrons. Under the action of the electric field, the electrons will flow from the negative electrode to the positive electrode. Since the electrons move very fast, they will collide with the gas molecules to ionize the gas and emit light and generate electricity, generating a large amount of current. When the irradiation ends, the movement stops, and a high impedance is present between the two stages.

Table 3: Performance metrics of the CO sensors.

Serial number	Parameter	Size	Unit
1	Operating voltage	5–12	V
2	Response time	≤60	s
3	Range	0–500	PPM
4	Operating temperature	15%–90%	RH

The U.S. health department proposed a carbon monoxide limit standard, which stipulates that carboxyhemoglobin does not exceed 2% as a basis. Considering the different levels of physical resistance, the environmental department has formulated a new standard: the concentration of carbon monoxide in the atmosphere should not exceed 1 mg/m^3 per day. Table 3 lists the performance indicators of the CO sensor.

The working principle of the carbon monoxide sensor is constant potential electrolysis. When carbon monoxide gas enters the sensor, the gas chemically reacts with the reaction device inside, and an electrical current is generated at the same time. The magnitude of the current is proportional to the concentration of carbon monoxide. The current will be amplified by the amplifying device and then output.

Nitrogen dioxide, an active gaseous substance, has a characteristic sweet taste. A common feature of these gases is that they cannot be detected by the human eye at all. But they

RETRACTED

RETRACTED

are everywhere, and the harm to the human body is invisible. At present, the sources of pollutants mainly come from vehicle exhaust gas and thermal power stations. In addition, the incomplete combustion of fuel will also produce a large number of hazardous substances. This article adopts the SAW-NO_2 sensor. Table 4 shows the characteristics and ratings of this sensor.

The working principle of the SAW-NO_2 gas sensor is that when NO_2 in the air is adsorbed to the sensor, the parameters on the sensor will change, and the detection of NO_2 can be realized by measuring the change of its frequency, phase, or differential loss.

The diameter of PM2.5 particles is very small, and these particles stay in the atmosphere for a long time, adsorbing many substances harmful to the human body, posing a great threat to human health. The PM2.5 sensor parameters used in this article are shown in Table 5.

The PM2.5 sensor adopts the principle of laser detection, and its working process is very simple. There is a laser module in the device, which will generate a laser beam when it is turned on. Its function is to detect particulate matter. When particles pass through, the signal will be detected by the digital circuit module, and the obtained data will be analyzed and summarized to calculate the diameter and number of particles. The conversion formula of particle size distribution and mass concentration is obtained by professional technology, and finally the unified mass concentration with the official announcement is obtained.

According to the needs of the experimental system, the design of the system software includes the sensor data acquisition program, the wireless data transceiver program, and the serial port communication module program. Each module cooperates to realize the function of the system.

Sensor data acquisition is the foundation and an indispensable part of the entire system. The quality of the sensor directly determines the accuracy of the data. Its role is to collect data and then transmit it to the microcontroller for transmission by the microcontroller. The sensor together with the processor and the transmitter module constitutes the sensor node.

The data transceiver module is equivalent to the role of a transfer station, receiving the data from the lower computer and then sending the data to the upper computer. When the terminal receives the data sent by the sensor, it needs to make a corresponding feedback signal, so that the sender can easily detect whether there is data loss. The data transmission module can make the response and retransmission at the same time. When there are data to send, it will start sending and wait for the feedback of the signal at the same time. If no feedback is received, it will automatically retransmit until there is a response.

The serial communication program sets up a bridge between the modules and realizes the connection between them. Before programming, the serial port is customized and initialized. It opens the serial port, sends the read data command, and finally needs the serial port data processing.

Table 4: Performance indicators of the NO_2 sensor.

Serial number	Parameter	Size	Unit
1	Concentration range	0–20	ppm
2	Output current	150 ± 30	nA
3	Reaction time	<25	s
4	Zero drift	<0.5	PPM
5	Temperature	−20~+50	°C
6	Pressure range	0.9–1.1	atm

Table 5: Performance specifications of the PM2.5 sensors.

Serial number	Parameter	Size	Unit
1	Range	0–999.9	ug/m^3
2	Supply voltage	150 ± 30	V
3	Maximum operating current	<25	nA
4	Response time	<0.5	s
5	Diameter resolution	−20~+50	um

The transmission protocol adopted by the host computer network communication system is the TCP/IP. TCP/IP is a very common transport protocol. The TCP protocol has two development modes: B/S mode and C/S mode. This article adopts the B/S mode.

The remote monitoring module receives the information obtained by the sensor, parses it, reads the data, and displays it on the monitor screen. Therefore, this experiment adopts the remote monitoring method of the web. It uses the mobile phone client to obtain the data on the server through the browser. It realizes server-side and browser-side information interaction.

This environmental monitoring system combines software and hardware and serves the functions of actual monitoring and querying of environmental parameters as well as data analysis. And it can provide a reference scheme for the restoration of the environment through the results of data analysis. It is conducive to maintaining the balance of the ecological cycle index system, thus reflecting the value of this research.

4. Multisensor Data Fusion Algorithm

Let the variance of each sensor be $\delta_1^2, \delta_2^2, \ldots, \delta_\xi^2$, the true value to be estimated is χ, and the test value of each sensor is $\chi_1, \chi_2, \ldots, \chi_\xi$. They are independent of each other and are unbiased estimates of χ. The weighting factors of each sensor are ε_1, $\varepsilon_2, \ldots, \varepsilon_\xi$, and $\chi_1, \chi_2, \ldots, \chi_\xi$ is weighted and fused, the fused $\overset{\Lambda}{\chi}$ value satisfies the following relationship:

$$\left\{ \overset{\Lambda}{\chi} = \sum_{\mu=1}^{\xi} \varepsilon_\mu \chi_\mu \sum_{\mu=1}^{\xi} \varepsilon_\mu = 1. \right. \tag{1}$$

The total variance is

$$\varepsilon^2 = E\left[(\chi - \overset{\Lambda}{\chi})^2 \right] = E\left[\left(\sum_{\mu=1}^{\xi} \varepsilon_\mu \chi - \sum_{\mu=1}^{\xi} \varepsilon_\mu \chi_\mu \right)^2 \right]. \tag{2}$$

It can be further sorted out as

$$\varepsilon^2 = E\left[\left(\sum_{\mu=1}^{\xi} \varepsilon_\mu^2 (\chi - \chi_\mu)^2\right)^2\right] = \sum_{\mu=1}^{\xi} \varepsilon_\mu^2 \varepsilon_\mu^2. \quad (3)$$

The solution to formula (4) is the minimum value of ε^2:

$$\begin{cases} \varepsilon_\mu^2 = \min\left(\sum_{\mu=1}^{\xi} \varepsilon_\mu^2 \varepsilon_\mu^2\right), \\ \sum_{\mu=1}^{\xi} \varepsilon_\mu = 1. \end{cases} \quad (4)$$

The optimal weighting factor corresponding to the minimum total variance is

$$\varepsilon_\mu^* = \frac{1}{\left(\varepsilon_\mu^2 \sum_{\mu=1}^{\xi} 1/\varepsilon_\mu^2\right)} \ (\mu = 1, 2, \cdots, \xi). \quad (5)$$

At this time, the minimum value of the corresponding total variance is

$$\varepsilon_{\min}^2 = \frac{1}{\sum_{\mu=1}^{\xi} 1/\varepsilon_\mu^2} \ (\mu = 1, 2, \cdots, \xi). \quad (6)$$

Supposing two independent sensors μ, ν, whose measurement values are χ_μ, χ_ν, respectively, the corresponding measurement error is η_μ, η_ν, and the true value to be estimated is χ, then:

$$\begin{cases} \chi_\mu = \chi + \eta_\mu \\ \chi_\nu = \chi + \eta_\nu \end{cases}. \quad (7)$$

The variance of sensor μ is

$$\varepsilon_\mu^2 = E\left[\eta_\mu^2\right]. \quad (8)$$

Therefore, the cross-covariance function $\varphi_{\mu\nu}$ of χ_μ, χ_ν satisfies

$$\varphi_{\mu\nu} = E\left[\chi_\mu \chi_\nu\right] = E\left[\chi^2\right]. \quad (9)$$

The autocovariance function of χ_μ satisfies

$$\varphi_{\mu\mu} = E\left[\chi_\mu^2\right] = E\left[\chi^2\right] + E\left[\eta_\mu^2\right]. \quad (10)$$

From formulas (8)–(10), we can get

$$\varepsilon_\mu^2 = E\left[\eta_\mu^2\right] = \varphi_{\mu\mu} - \varphi_{\mu\nu}. \quad (11)$$

The value of $\varphi_{\mu\mu}, \varphi_{\mu\nu}$ can be obtained from its time domain estimate.

If the number of sensor measurements is ϖ, the time domain estimated value of $\varphi_{\mu\mu}$ is $\varphi_{\mu\mu}(\varpi)$, and the time domain estimated value of $\varphi_{\mu\nu}$ is $\varphi_{\mu\nu}(\varpi)$, then

$$\varphi_{\mu\mu}(\varpi) = \frac{1}{\varpi} \sum_{\omega=1}^{\varpi} \chi_\mu(\omega) \chi_\mu(\omega) = \frac{\varpi - 1}{\varpi} \varphi_{\mu\mu}(\varpi - 1) + \frac{1}{\varpi} \chi_\mu(\varpi) \chi_\mu(\varpi). \quad (12)$$

The same can be obtained:

$$\begin{aligned} \varphi_{\mu\nu}(\varpi) &= \frac{\varpi - 1}{\varpi} \varphi_{\mu\nu}(\varpi - 1) + \frac{1}{\varpi} \chi_\mu(\varpi) \chi_\nu(\varpi), \\ \varphi_{\mu\nu} = \bar{\varphi}_{\mu\nu}(\varpi) &= \frac{1}{\xi - 1} \sum_{\substack{\nu=1 \\ \nu \neq \mu}}^{\xi} \varphi_{\mu\nu}(\varpi), \\ E[\chi - \hat{\chi}] &= E\left[\sum_{\mu=1}^{\xi} \varepsilon_\mu (\chi - \chi_\mu)\right] = 0 \end{aligned} \quad (13)$$

That is, $\hat{\chi}$ is an unbiased estimate of χ.

Let V be a recognition frame, then the function

$$\phi: 2^V \longrightarrow [0, 1]. \quad (14)$$

The following conditions:

$$\begin{aligned} \phi(\varnothing) &= 0, \\ \sum \phi(\beta) &= 1. \end{aligned} \quad (15)$$

$\phi(\beta)$ is the basic probability assignment of proposition β.

Trust function on V is

$$\gamma(\beta) = \sum_{\alpha \cap \beta \neq \varnothing} \phi(\alpha). \quad (16)$$

Besides,

$$\begin{aligned} \gamma(\varnothing) &= 0, \\ \gamma(V) &= 1. \end{aligned} \quad (17)$$

This research fuses multisensor data through the adaptive weighted fusion algorithm and D-S evidence theory involved, so as to process the data collected by the sensors used in the system. It can visually see the environmental monitoring results of the farmland ecological cycle index system in the system.

The system uses the S3C2440 processor as the core to cooperate with various sensors to collect data and uses the embedded server as the server. The upper computer adopts the mobile phone client software and performs data transfer with the server through the browser. The whole process is provided by the GPRS network to send and receive data.

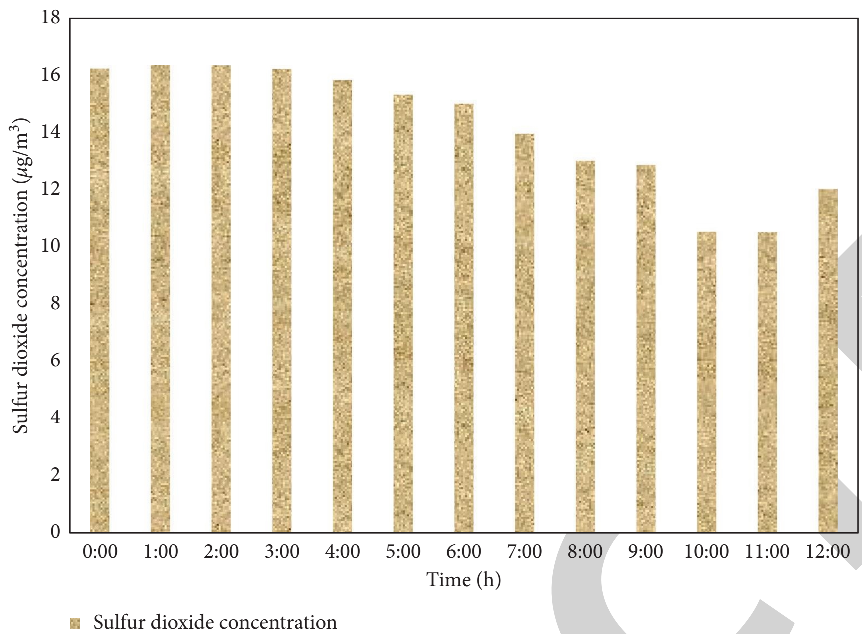
The system was tested in a university lab in September 2021. The sulfur dioxide concentration measurement data are shown in Figure 7.

Figure 7 shows that the concentration of sulfur dioxide showed a change in the whole day, which first decreased and then increased, but the concentration of sulfur dioxide at the two time points of 12:00 and 13:00 was different. In addition, the concentration of sulfur dioxide was the highest at 1:00, 16.37 $\mu g/m^3$, and the lowest at 11:00, 10.52 $\mu g/m^3$.

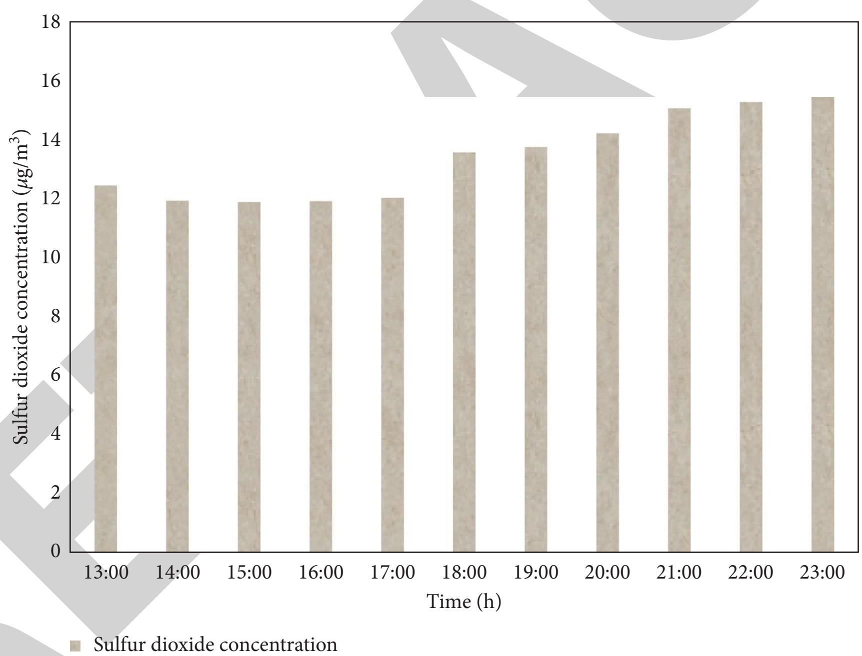
The measured data of the carbon monoxide sensor and UV intensity are shown in Figure 8.

Figure 8(a) shows that the concentration of carbon monoxide is 2 mg/m^3 except between 7:00 and 10:00 throughout the day. The other time points were stable at 1 mg/m^3. Overall, the content of carbon monoxide was relatively fixed in the entire farmland ecological cycle index system. Figure 8(b) shows that the UV intensity is higher as it reaches noon, and the UV intensity at 13:00 is the highest, which is 26 w/m^2. And before 4:00 and after 20:00, the

RETRACTED



(a)



(b)

Figure 7: Measurement data of sulfur dioxide concentration.

RETRACTED

ultraviolet intensity is 0 w/m^2, which is related to the orbit of the sun.

The measurement data of nitrogen dioxide are shown in Figure 9.

Figure 9 shows that the concentration of nitrogen dioxide is 90 mg/m^3 at 23:00, which is the highest concentration of nitrogen dioxide in a day. And at 13:00, it is 30 mg/m^3.

The test data of the PM2.5 sensor are shown in Figure 10.

Figure 10 shows that the PM2.5 concentration is the highest at 22:00, which is 59 μg/m^3, and the PM2.5 concentration is the lowest at 14:00, which is 22 μg/m^3. The concentration of PM2.5 in one day showed a wave-shaped trend, first decreased and then increased, then gradually decreased, and finally gradually increased. At the same time, the data show that the system meets the environmental monitoring requirements of the farmland ecological cycle index system.

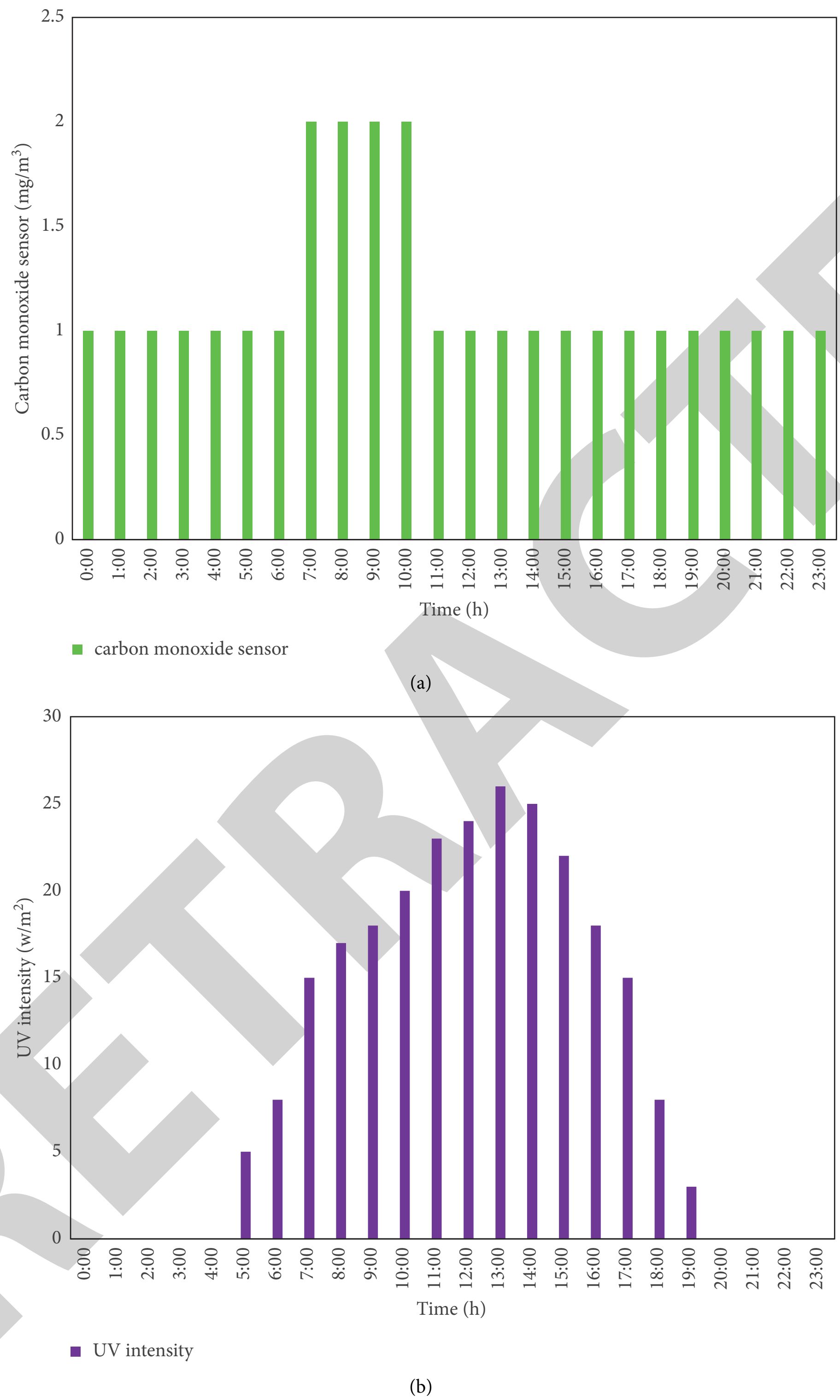


Figure 8: Measurement data for carbon monoxide sensor and UV intensity.

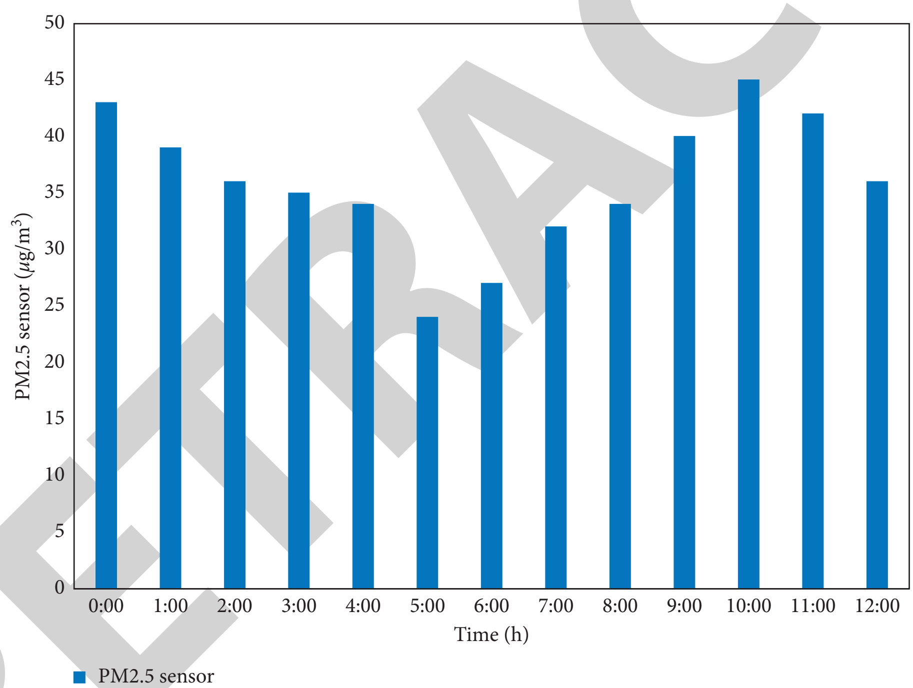
RETRACTED

The experimental results show that the system can monitor the farmland environment, and the monitoring results are compared with the relevant departments, and the result is that the data are accurate.

Due to changes in environmental conditions, there are certain deviations in monitoring data affected by various environmental factors. The main factors analyzed are as follows:

When measuring the data, they are constantly changing in real time, the changes with the location and time are not fixed, and the measurement accuracy of the sensor itself cannot reach the measurement accuracy marked on it. There

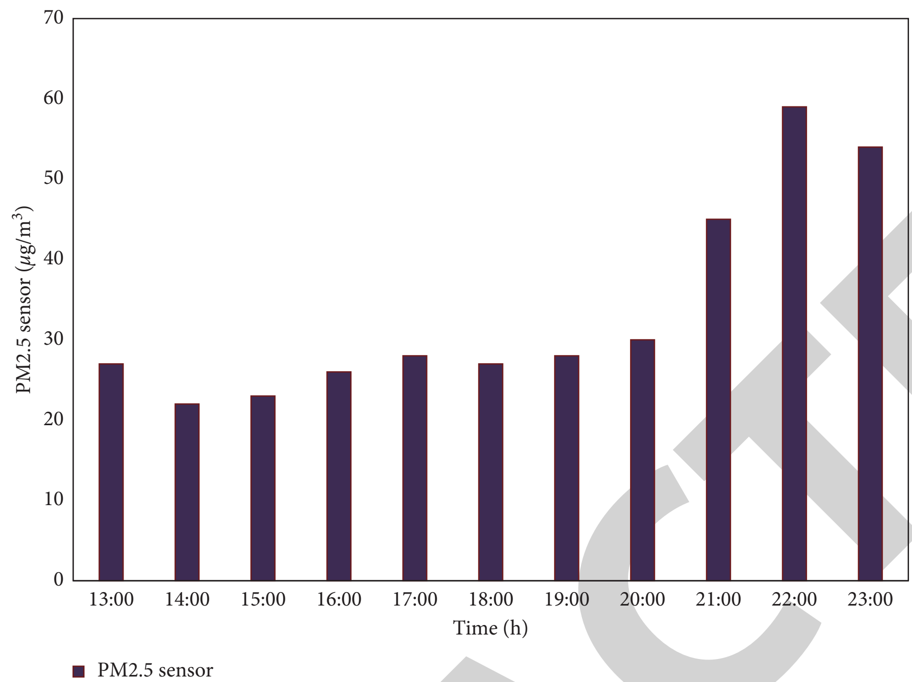
FIGURE 9: Measurement data for nitrogen dioxide.



(a)

FIGURE 10: Continued.

RETRACTED



(b)

FIGURE 10: Test data for the PM2.5 sensor.

are also changes in the external environment such as wind speed, temperature, pressure, humidity, etc., which have a certain impact on the data obtained by the sensor.

Solution: It can measure data multiple times, use different calculation methods for comparative analysis, exclude data with large errors, and minimize errors as much as possible. At the same time, when measuring, it is necessary to ensure the environmental factors where the sensor is located and try to minimize the impact of the environment on the sensor.

5. Discussion

The general application of agricultural Internet of Things is to form a monitoring network with a large number of sensor nodes. It collects information through various sensors to help farmers spot problems in time and pinpoint the exact location of the problem. In this way, agriculture will gradually shift from a human-centered production model that relies on isolated machinery to an information- and software-centered production model. It uses a lot of automated, intelligent, and remote-controlled production equipment.

Through the monitoring data of the farmland environment, the current crop growth status can be judged, and the farmland management can be carried out in a targeted manner according to the location, so as to provide a suitable environment for the growth of crops. It achieves high yield of crops. It can distribute the detection system in every corner of the farmland to conduct targeted detection. By collecting farmland data in different regions, we can find out the environmental conditions of each region and make them suitable for local conditions, so that crops can grow better. By collecting a large amount of data, it can observe and analyze the data to find out the law of environmental changes. At the same time, it summarizes the obtained environmental data, which can be used as an important parameter of environmental governance to provide help for crop planting in farmland.

The environmental damage caused by economic development makes people realize the importance of the environment. According to the data, it is foolish to obtain economic growth at the cost of consuming a lot of resources, because environmental resources are limited, and the incomplete utilization of resources will cause great harm to people's health. And the economy is not sustainable. China's development is progressing steadily, and resources should be used rationally to achieve sustainable development.

Everything we do is human-centered, and if what we do is harmful to humans, then our original intentions are meaningless. Therefore, environmental protection is not only the management of the environment but also the protection of human beings. The ultimate goal of environmental protection is to benefit mankind. The purpose of environmental monitoring is to obtain data in preparation for environmental protection. The key work of environmental governance is prevention. In order to protect the ecological environment, it is necessary to obtain real-time information on the ecological environment. Only in this way can we prepare in advance to protect the environment, which is ecological environment monitoring. Ecological environment monitoring is the focus of environmental protection. It can be specifically summarized as follows: (1) environmental assessment is based on the collected data; (2)

RETRACTED

collecting real-time data and summarizing the data in combination with historical data to obtain the law of environmental changes; (3) protecting the farmland environment and formulating measures.

6. Conclusion

According to the comprehensive consideration of actual needs, this article proposes a remote monitoring scheme of embedded and GPRS technology and conducts a preliminary analysis and design of the general framework of the system. Next, this article builds the platform of the Linux operating system. Then, the hardware structure of the system is designed and implemented. The control chip of the system selects S3C2440; the SO_2-10 sensor is selected for sulfur dioxide gas detection, the ZWX-R4 sensor is selected for ultraviolet detection, and the ZE07-CO sensor is selected for carbon monoxide gas detection. The SAW-NO2 sensor is selected for nitrogen dioxide gas detection, and SDS011 sensor is selected for PM2.5 dust detection. Wireless communication module detection selects SIM300 GPRS module. Finally, it carries out the design of the software program. On the basis of mastering the working principle of the sensor, the data acquisition program, data sending and receiving program, serial communication program, and monitoring center program design are further developed. The mobile client software is developed based on the Android system. This article introduces the production and writing steps of the mobile client in detail. Finally, it realizes the development of mobile client. The experimental monitoring results showed that the concentration of 2.5 at 22:00 pm was the highest at 59 $\mu g/m^3$, and the concentration of 2.5 at 14:00 pm was the lowest at 22 $\mu g/m^3$. Compared with the detection data of traditional relevant departments, the accuracy rate has increased by 1.06%. Through the research and design of the remote monitoring system, this article has a new understanding of the remote monitoring system. Although the design meets the expected requirements, there are still some aspects that need to be further improved. For example, the measurement accuracy of the sensor needs to be further improved due to various factors, the GPRS signal is unstable, the obtained data are lost, and the APP function needs to be increased. The next improvement of the experiment can add camera function so that users can understand the environment more intuitively.

Data Availability

No data were used to support this study.

Conflicts of Interest

The author declares no conflicts of interest.

References

[1] M. Ekström, P. A. Esseen, B. Westerlund, A. Grafstrom, B. Jonsson, and G. Stahl, "Logistic regression for clustered data from environmental monitoring programs," *Ecological Informatics*, vol. 43, pp. 165–173, 2018.

[2] M. Tanona and P. Czarnota, "Index of Atmospheric Purity reflects the ecological conditions better than the environmental pollution in the Carpathian forests," *Journal of Mountain Science*, vol. 17, no. 11, pp. 2691–2706, 2020.

[3] S. E. Darrah, Y. Shennan-Farpon, J. Loh et al., "Improvements to the Wetland Extent Trends (WET) index as a tool for monitoring natural and human-made wetlands," *Ecological Indicators*, vol. 99, pp. 294–298, 2019.

[4] V. A. Rybak and O. P. Ryabichina, "Ecological monitoring system of the atmosphere," *Doklady BGUIR*, vol. 18, no. 4, pp. 36–43, 2020.

[5] V. Pohrebennyk, P. Koszelnik, O. Mitryasova, E. Dzhumelia, and M. Zdeb, "Environmental monitoring of soils of post-industrial mining areas," *Journal of Ecological Engineering*, vol. 20, no. 9, pp. 53–61, 2019.

[6] H. Y. Krasovskyi, V. O. Shumeiko, T. O. Klochko, and N. I. Sementsova, "Information technologies for monitoring the environmental consequences of amber production in Ukraine," *Ecological Safety and Balanced Use of Resources*, vol. 2, no. 18, pp. 107–117, 2018.

[7] M. L. Myrontsov and V. O. Okhariev, "Information system of decision making support for sustainable natural resource management and environmental safety," *Environmental Safety and Natural Resources*, vol. 37, no. 1, pp. 69–82, 2021.

[8] S. Chen and J. Yan, "Environment evaluation index system for environment ecological assessment and independent innovation ability of environmental BIO industry cluster based on copula function," *Journal of Environmental Protection and Ecology*, vol. 19, no. 3, pp. 1037–1046, 2018.

[9] N. Duan, X. D. Liu, J. Dai et al., "Evaluating the environmental impacts of an urban wetland park based on emergy accounting and life cycle assessment: a case study in Beijing," *Ecological Modelling*, vol. 222, no. 2, pp. 351–359, 2011.

[10] S. E. Buday, "Determining afforestation areas by using social, economic and ecological scales," *Environmental Monitoring and Assessment*, vol. 193, no. 4, pp. 1–12, 2021.

[11] V. M. Trysnyuk, V. O. Okharev, T. V. Trysnyuk, and Y. M. Holovan, "System of ecological monitoring of pedosphere pollution by petroleum products," *Environmental Safety and Natural Resources*, vol. 34, no. 2, pp. 22–29, 2020.

[12] M. J. Colloff, I. C. Overton, B. L. Henderson et al., "The use of historical environmental monitoring data to test predictions on cross-scale ecological responses to alterations in river flows," *Aquatic Ecology*, vol. 52, no. 1, pp. 133–153, 2018.

[13] D. Braun, A. Damm, L. Hein, O. L. Petchey, and M. E. Schaepman, "Spatio-temporal trends and trade-offs in ecosystem services: an Earth observation based assessment for Switzerland between 2004 and 2014," *Ecological Indicators*, vol. 89, no. JUN, pp. 828–839, 2018.

[14] A. M. Belyakov, A. V. Koshelev, and M. V. Nazarova, "Assessment of the environmental balance in agricultural landscapes of the dry steppe zone (Chestnut Soils, Volgograd Oblast)," *Arid Ecosystems*, vol. 12, no. 1, pp. 108–112, 2022.

[15] J. van Schalkwyk, J. S. Pryke, and M. J. Samways, "Contribution of common vs. rare species to species diversity patterns in conservation corridors," *Ecological Indicators*, vol. 104, pp. 279–288, 2019.

[16] E. Martinez-Garcia, R. Capaccioni-Azzati, J. L. Sanchez-Lizaso, and P. Sanchez-Jerez, "Application of a new protocol to evaluate the benthic impacts of aquaculture: colonization of experimental units for monitoring by polychaeta," *Ecological Indicators*, vol. 101, pp. 50–61, 2019.

[17] J. Lei, "Reforming the natural resource auditing system from the ecological civilization perspective," *Chinese Journal of*

RETRACTED

Population, Resources and Environment, vol. 18, no. 2, pp. 87–96, 2020.
[18] W. Dai, J. Dong, W. Yan, and J. Xu, "Study on each phase characteristics of the whole coal life cycle and their ecological risk assessment—a case of coal in China," *Environmental Science and Pollution Research*, vol. 24, no. 2, pp. 1296–1305, 2017.
[19] S. S. Gill, I. Chana, and R. Buyya, "IoT based agriculture as a cloud and big data service: the beginning of digital India," *Journal of Organizational and End User Computing*, vol. 29, no. 4, pp. 1–23, 2017.
[20] T. Popovic, N. Latinovic, A. Pesic, Z. Zecevic, B. Krstajic, and S. Djukanovic, "Architecting an IoT-enabled platform for precision agriculture and ecological monitoring: a case study," *Computers and Electronics in Agriculture*, vol. 140, no. 140C, pp. 255–265, 2017.
[21] C. Brewster, I. Roussaki, N. Kalatzis, K. Doolin, and K. Ellis, "IoT in agriculture: designing a europe-wide large-scale pilot," *IEEE Communications Magazine*, vol. 55, no. 9, pp. 26–33, 2017.
[22] S. Taraknath, M. Vigneshwaran, and V. Nithees, "Smart agriculture by using IoT," *International Journal for Modern Trends in Science and Technology*, vol. 7, no. 7, pp. 175–178, 2021.
[23] B. Miles, E. B. Bourennane, S. Boucherkha, and S. Chikhi, "A study of LoRaWAN protocol performance for IoT applications in smart agriculture," *Computer Communications*, vol. 164, no. 2020, pp. 148–157, 2020.
[24] O. I. Khalaf and G. M. Abdulsahib, "Optimized dynamic storage of data (ODSD) in IoT based on blockchain for wireless sensor networks," *Peer-to-Peer Netw. Appl,* vol. 14, no. 5, pp. 2858–2873, 2021.
[25] A. R. W. Sait, I. Pustokhina, and M. Ilayaraja, "Modeling of multiple share creation with optimal signcryption technique for digital image security," *Journal of Intelligent Systems and Internet of Things*, vol. 0, no. 1, pp. 26–36, 2019.
[26] O. Friha, M. A. Ferrag, L. Shu, L. Maglaras, and X. Wang, "Internet of things for the future of smart agriculture: a comprehensive survey of emerging technologies," *IEEE/CAA Journal of, Automatica Sinica*, vol. 8, no. 4, pp. 718–752, 2021.
[27] S. Yadav, D. Garg, and S. Luthra, "Ranking of performance indicators in an Internet of Things (IoT)-based traceability system for the agriculture supply chain (ASC)," *International Journal of Quality & Reliability Management*, vol. 39, no. 3, pp. 777–803, 2022.
[28] H. Wei and N. Kehtarnavaz, "Semi-supervised Faster Rcnn-Based Person Detection and Load Classification for Far Field Video Surveillance," *Mach. Learn. Knowl. Extr*, vol. 1, no. 3, 2019.
[29] J. Yang and Z. Liu, "Smart agriculture and IoT technology," *Asian Agricultural Research*, vol. 14, no. 2, pp. 10–13, 2022.

RETRACTED