Research on the Information Collection System of Bohai Sea Granary Based on Android

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Abstract: It is an important demand for the Bohai Science and Technology Demonstration Project to quickly and accurately obtain real-time and dynamic data of crops and their growing environment, and achieve fast, accurate, multi-dimensional and multi-scale real-time monitoring. In order to solve this problem, a research method of information acquisition system based on Android platform is proposed. The system is based on the C/S architecture, which enables users to quickly obtain the growth environmental parameters of crops on the mobile platform. The article introduced the overall framework design of the system, the main functions of the system (real-time data query, pest and disease monitoring and early warning, historical data mining analysis, and service reminding) and the implementation principle of each function module. The specific implementation of the system client and server were performed respectively. Detailed explanation. The system has been practically applied in the Bohai Science and Technology Demonstration Project to implement data query display, data mining analysis, service reminding, and monitoring and alerting on the mobile phone's Android. It has achieved good results and fully reflects the convenience of the Android mobile platform.

1. Introduction

In recent years, with the rapid development of embedded technologies and Internet technologies, intelligent networking devices have become more and more popular, the informationization of agricultural production environment is becoming more and more urgent, and the requirements for the accuracy and real-time performance of environmental information are also increasing. The traditional environmental information collection and display equipment has been difficult to meet the current needs. The use of mobile devices such as mobile phones to obtain and operate agricultural production environment information has become a trend in the future [1].

With the development of global smart phones and the continuous advancement of 4G network coverage projects, smart phones have been rapidly developed and applied. In particular, Android smartphones have been widely and effectively used in various fields after the Android platform's smartphones have been continuously updated and improved [2]. Therefore, based on the Android platform, the agricultural information network information collection system provides data for agriculture's convenient, real-time, accurate, effective and visual monitoring and management, and promotes the development of information and intelligence in agricultural production [3]. Yin Guowei [4] improved the promotion of agricultural technology management through the use of Android-based agricultural technology promotion data collection system to submit agricultural technology promotion work logs, publish agricultural product prices, report agricultural disasters, upload agricultural prescriptions, conduct experience exchanges, and answer questions and answers. Provide more localized and targeted information services; Francisco G.Montoya et al. [5] introduced

an application for Android tablets that interacts with advanced control systems based on Linux, Apache, MySQL, PHP, Perl, or Python (LAMP) to collect and monitor variables in precision agriculture applications. V. Prabhakaran and others [6] used smart sensors and GSM modules to design automatic irrigation systems. GSM control operation commands were sent via Android mobile phones to report detailed irrigation information.

Aiming at the application of the current Android platform in agricultural intelligence information collection, combined with the Bohai Sea Granary Technology Demonstration Project, an Android-based information collection system was developed and designed [7]. The Bohai Sea Granary is a huge agricultural science and technology project involving more than 1.1 million square kilometers of land and 260 million people, accounting for approximately 13.3% of the country's total land area and 22.2% of the total population. The plan is to achieve the goal of increasing grain output by 6 billion kilograms by 2017 and increasing grain by 10 billion kilograms by 2020 by renovating more than 40 million mu of medium and low-yielding fields and more than 10 million acres of saline-alkali wasteland in the Bohai Rim area. Alkali disaster in the Bohai Rim region constitutes an important "granary" in China. In order to better promote the development of the granary in the Bohai Sea, convenient and quick access to data information has become an important issue. It can realize real-time and dynamic viewing of crop growth environment information, realizing rapid, accurate, multi-dimensional and multi-scale real-time monitoring, providing important basis for planters to make scientific decisions, and is of great significance for promoting the development of Bohai Science and Technology Demonstration Project.

2. System Overall Design

The development of this system is based on the MVC model of the C/S structure. The C/S structure, that is, the client/server structure, is shown in Fig.1. The overall system is divided into two parts: the client and the server, and the two are connected through the network. The main function of the client is to receive user instructions and to display user request data. The main function of the server is to query the user's required data from the database according to the user's request and provide the result to the user. Both display logic and transaction logic are placed on the client, and data processing logic and database are placed on the server side.

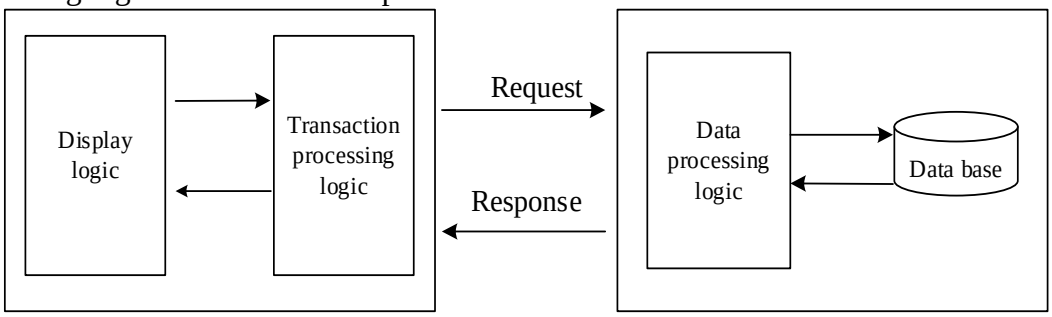

Fig. 1 C/S function model

MVC mode is Model, View, Controller. This model divides the system into three parts: a model, a view, and a controller [8]. The hierarchy is shown in Fig.2. The model contains all the data, behaviors, and business rules needed to complete the business. The model of the system is implemented on the server side. The main manifestation is the created entity class, which encapsulates the data and business logic; the view is a visual element of the program. It is used to interact with the user. In this system, the View mainly represents the control operation and data display interface displayed by the Android client to the user; the various events and services of the controller control system are the link between the view and the model. The controller of the system is mainly embodied in the service processing part of the server-side Servlet. When the server receives the user request sent by the client, it calls other components to complete the user's data request, and the processed request data is

returned to the client.

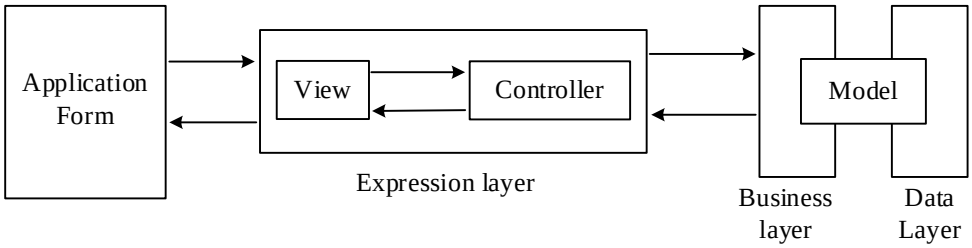

Fig. 2 Hierarchical structure of C/S structure based on MVC pattern

Based on the analysis of the above major technical frameworks, the actual development of the system will be based on the android platform of the Bohai Sea Granary Management System combined with software engineering related knowledge framework, given the development of the system's technology roadmap shown in Fig.3.

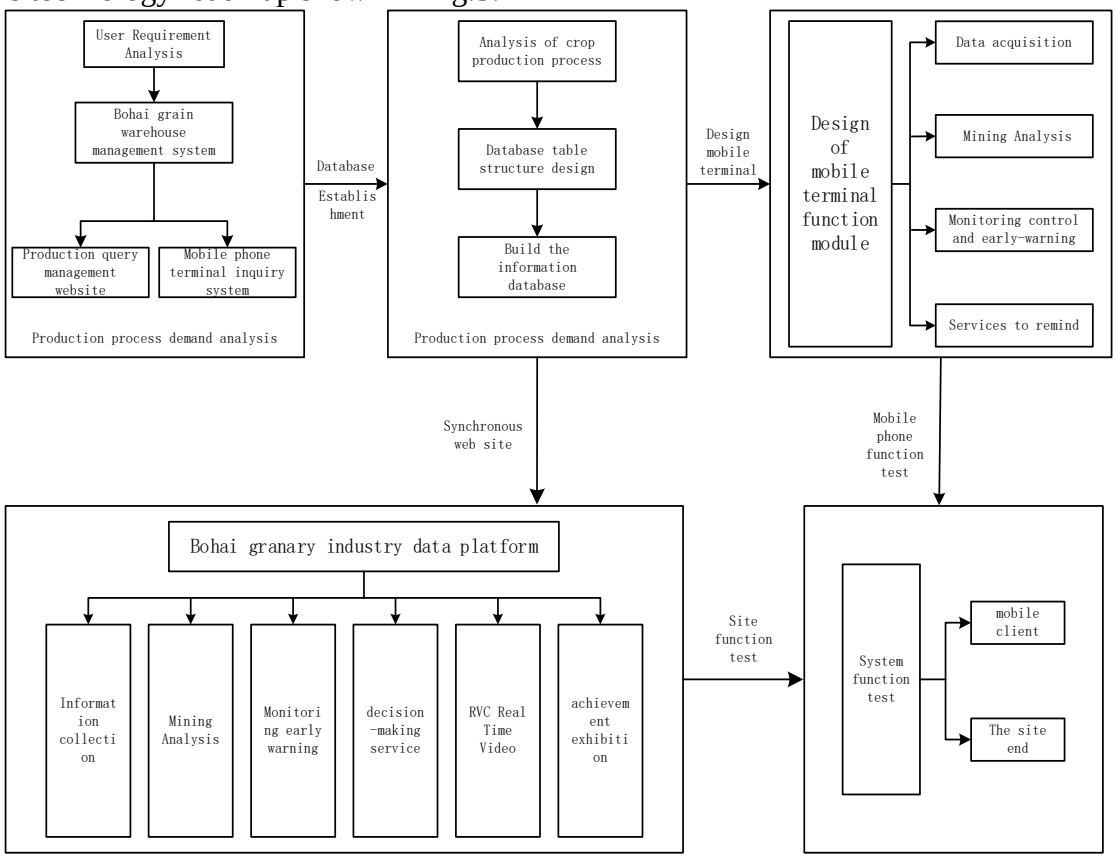

Fig. 3 System technical line reference diagram

3. Server Design

Selecting the JAVA WEB project as a server has the advantages of high security and strong stability. Its basic structure can be divided into three layers. From the physical point of view, it is divided into three layers: client, application server, and database server. From a logical perspective, it is divided into a presentation layer, a business logic layer, and a data access layer. The physical layer, strictly speaking, does not belong to any of the three layers. It is independent of the other three layers and can only be referenced by other layers, but cannot refer to the other three layers.

The system server design adopts the design combination of Servlet +DAO+JavaBean+JDBC. The server invokes the Dao layer method in the Servlet to complete the business processing function. DAO as a data access layer, access to the database, such as the addition, deletion, modification, and query of the database data; the main advantages of using the DAO mode are abstract data access methods (adding, deleting, checking, etc.), accessing the data source (database) At that time, the

existence of data sources (databases) was completely felt, data access was concentrated on a separate layer, all data access was delegated by DAO, and the implementation of data access was stripped from the rest of the system. The specific data processing flow of the server is shown in Fig.4. The Servlet of the business logic layer obtains the user request data from the database by calling the DAO of the data access layer. The Servlet encapsulates the data into JSON format data and feeds it back to the client.

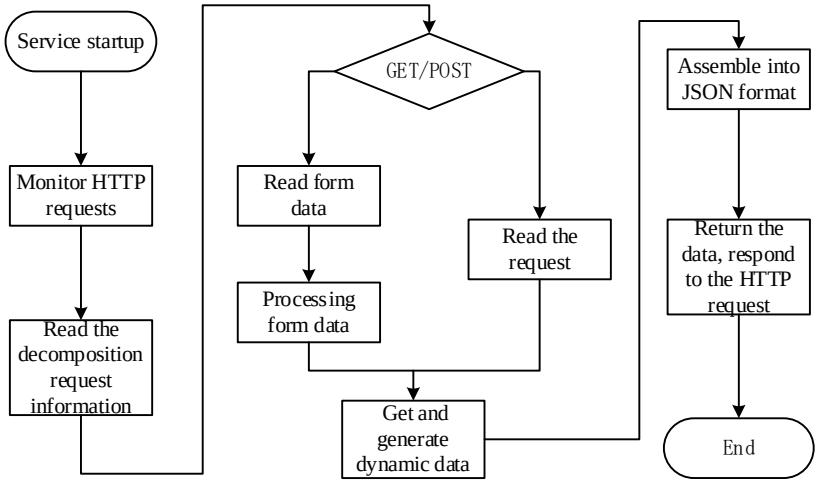

Fig. 4 **S**erver data processing flowchart

4. Server Design

4.1 Functional Design

The key to smart agriculture lies in making agricultural production and agricultural management more intelligent, convenient, scientific and efficient, and providing farmers with various information related to agricultural production and agricultural management. The core function framework diagram of the Android client is shown in Fig.5. It mainly includes the following functional modules: monitoring and warning, data query, mining analysis and service reminding.

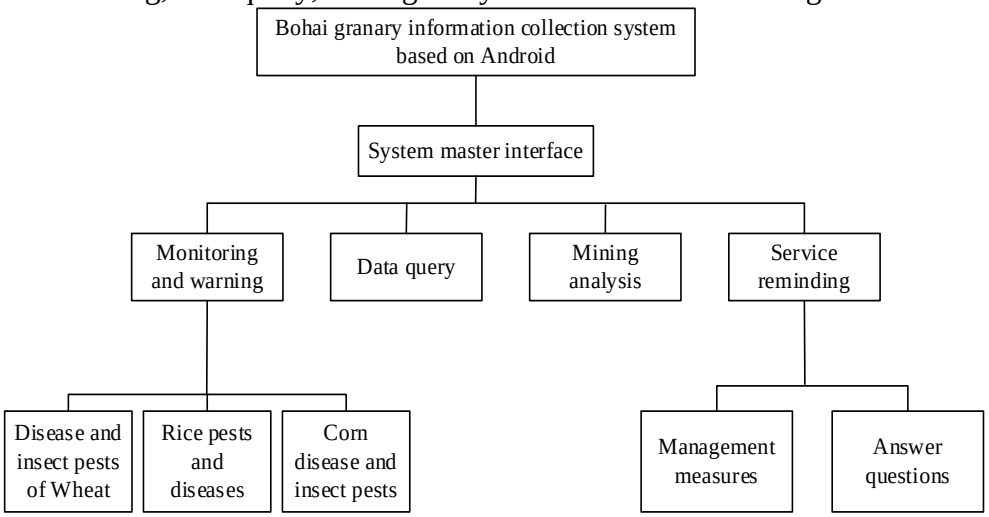

Fig. 5 Client core functional framework

4.2 Network Module

In the design of the entire Android phone of the mobile phone, various types of data are obtained through two-way communication with the remote server. Therefore, the network module is a part that needs to be considered in the entire system design.

The Android client needs to consume indefinitely long time when performing network operations. Especially when the network is jammed and the amount of data transmission is too large, placing the network operation on the main thread (UI thread) will cause the interface to load and block, or even appear. Application is not responding error. In order to make the interface operate more smoothly and improve the system stability, it is necessary to process the network tasks for various types of network operations (mainly Http requests and responses) and open threads or adopt asynchronous loading. Therefore, the data transmission mode between the client and the server is designed to use asynchronous HTTP communication. When the client requests and responds to the network each time, the default HTTP client object httpclient is obtained by using DefaultHttpClient in the asynchronous loading process. At the same time, HttpPost generates an HTTP POST object, then uses ArrayList to put the key value pairs of POST content, and finally sends out an actual HTTP POST request through httpclient's execute() method to implement the network request submission and server data reception when the data is received. After completion, asynchronous loading will automatically notify the main thread (UI thread) to fill in the interface data to solve the problem of interface blocking caused by network requests.

The network connection module is mainly used to complete the network connection between the mobile terminal and the server. Before linking the server, first determine whether the mobile phone is in the network connection state. In the normal state of the mobile network, when the mobile phone starts the linked page, the system will create A Thread thread, which is mainly responsible for the data reception processing of the socket connection. If the connection between the mobile terminal and the server is normal, the created Handler class object is used to call a specific sending method to process the update page.

4.3 Data Synchronization Module

The specific process of data synchronization between the client and the server is based on a "request-response mode." The client sends an HTTP request to the server using asynchronous loading, and the server responds to the user's request. When the user makes a request, a child thread is started in the main thread. The sub-threads are used exclusively for data exchange between the client and the server, mainly for sending request data and receiving data returned by the server. The use of multi-threading technology will make the program more responsive, enabling the main thread to respond to more tasks in a shorter time, allowing the user's other requests to respond quickly and better to achieve a friendly relationship between people and the system. The sample code is as follows:

```
Public void run() {
        String result;
        Map<String, String>params=new HashMap<String, String>();
                params.put("DTU", DTU);
                try {
                result=Util.sendPostRequest(Info.PATH1, params, "UTF-8");
                        if(result.equals("fail")){
                        handler.sendEmptyMessage(0);
                                }
                            else{
                                parseJson(result);
                             }
                }
                catch (Exception e) {
                        // TODO Auto-generated catch block
                        e.printStackTrace();
                }
}
```

4.4 Data Processing Module

In network operations, the data format returned by the server generally uses XML parsing and JSON parsing. The XML file is large, the format is complex, and the transmission bandwidth is relatively wide. The JSON format is simple and the bandwidth is small. The data is directly parsed through key values [9]. The amount of data involved in this design is relatively small and the format is simple. Therefore, JSON is used as a data exchange format between the client and the server. JSON is a lightweight data transfer format that allows data exchange between multiple languages. JSON represents data as a collection of name/value pairs. In this system, the Android client is mainly used to parse the data stream in the JSON format. After the JSON Object class gets the JSON object from the httpResponse, the JSON Object's getXxx method can retrieve the corresponding JSON object property.

In view of the unstable network resources available on the mobile phone itself, we should minimize the amount of data that each client requests from the server. When the system design acquires the data sent from the server, the data is persisted in the local database of the mobile phone. When the next network request is made, if the data to be requested includes the data that has been requested before, the data is directly from the local database of the mobile phone. Take out the corresponding part, in order to save the time cost that the single data communication brings, data communication cost, improve the response speed and stability of the system.

According to the actual situation, the design of the local database of the client adopts a SQLite database with small size, complete functions, fast access speed, and open source code, which can not only improve the access efficiency but also save resources.

4.5 Human-machine Interface Interaction Design

A good man-machine interface interaction design can win more users for the platform, facilitate the user to view and operate the data, and it is also an intuitive manifestation of the success of software design. The theme of the Android software interface adopts a relatively simple design style, while reducing the user's direct text input, adding pictures, line charts and other functions to facilitate user viewing and operation.

5. System Implementation

5.1 Data Query

The system realizes real-time meteorological data (air temperature, air humidity, CO_2 concentration, light intensity, wind speed, wind direction, etc.), soil data (soil temperature, soil moisture, soil conductivity, etc.) in the monitored area through the data query interface. , Water level data and other crop growth environmental parameter information, and can view the historical crop growth environment parameter information, the data is presented in the form of a list, line chart, convenient for users to view the data, understand the trend of crop growth environment parameters to help users make scientific decisions .

5.2 Mining Analysis

Through the integration of big data and agricultural science analysis technology, the agricultural big data analysis technology system is built, relevant historical data and real-time data are analyzed, and visualization technology is applied to dynamically present and analyze the analysis results, providing timely guidance for agricultural production, monitoring and early warning, and management decision-making. Reliable basis.

5.3 Monitoring and Aarly Warning

The monitoring and early warning mainly achieved pest and disease monitoring of crops in the grain warehouses of the Bohai Sea, including monitoring of wheat pests, diseases and pests of rice and rice pests and diseases. Through real-time collection and data analysis, dynamic monitoring of

factors affecting agricultural production, such as meteorology, soil, groundwater, diseases and pests, and crop growth indicators, and the implementation of early warnings based on the appropriate growth thresholds for crops, will prevent and scientifically treat pests in agricultural production in advance. Disasters provide warning information.

5.4 Service Alert

The service reminder system implements technical guidance based on the current season and crop growth cycle stages to help make scientific decisions, and users can present their own questions and inconsistencies in agriculture whenever and wherever possible to guide agricultural production in a timely manner. Provide reliable measures and scientific evidence. The system implementation interface is shown in Fig.6- Fig.10.

Fig. 6 System main interface

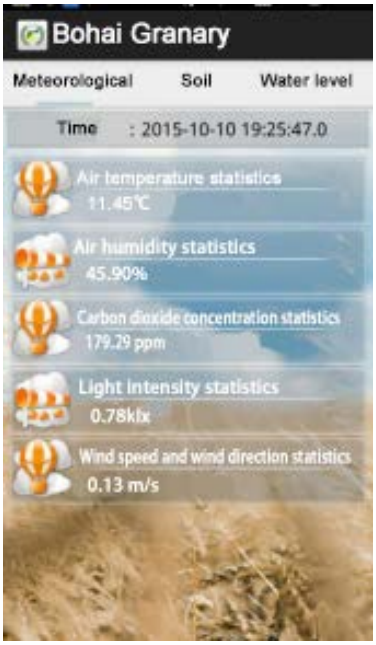

Fig.7 Data query display interface

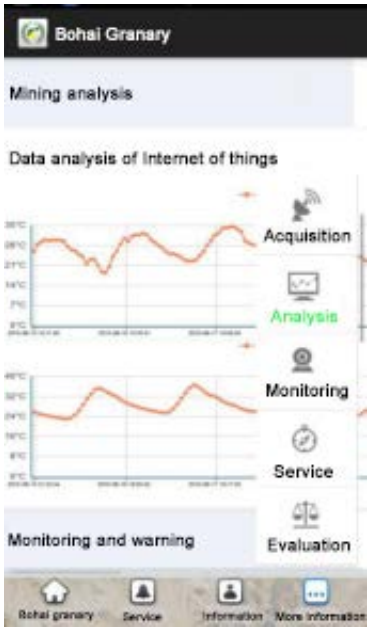

Fig.8 Data mining analysis interface

Fig.9 Service Alert Interface

Fig.10 Monitoring Alert Interface

6. Conclusions

This Android platform is a system developed to solve the problem of convenient, fast, real-time and accurate access to data in Bohai Sea granaries. The system mainly implements real-time data query on the real monitoring areas of Bohai Sea grain, mining and analysis of historical data, and meets the crop growth cycle. Service alerts and monitoring and warning of pests and diseases. After research and development, testing, adjustment and optimization, and demonstration applications, the platform now possesses the characteristics of the diversity of sources of massive data, the integration of historical and real-time data, and multi-factor comprehensive analysis and decision-making, and is applied to the typical plots of the Shandong project area of the Bohai Granary. During the food production management and decision-making process, it effectively guided the grain production in the project area and effectively supported the smooth progress of the Bohai Science and Technology Demonstration Project. Through practical applications, the system not only solves the problem of accurate acquisition of real-time data in the Bohai Sea grain warehouse. At the same time, monitoring and early warning of diseases and pests and data mining and analysis in the system are of great significance in helping users make scientific decisions.

In the future information collection of the agricultural production environment, the application of the smart agricultural system will be more extensive. Users will see the benefits brought by the use of advanced technologies and will actively choose the intelligent systems that are suitable for their own agricultural production in order to increase the output of agricultural products and increase their income. In the future of agricultural data processing, as cloud computing technology continues to mature, agricultural data is more accurate, safe, and intelligent. The agricultural data processing system will actively analyze the varieties that are most suitable for planting in the area and the advantages and disadvantages of various varieties for users to choose.

Acknowledgments

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