Research on Key Technologies of Cement Intelligent Control Cloud Platform Client

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Keywords: Frame Design, Web Service, JSON.

Abstract. The cement intelligent control cloud platform aims to implement the centralized and flat dynamic monitoring and digital management of the planning, production, scheduling and consumption links of cement enterprises with the help of information and automation technology and centralized management mode. All kinds of running energy parameters will be continuously transmitted to the system server, and the managers can communicate with each other. It can realize all kinds of data analysis and real-time monitoring of energy consumption information, and can take timely measures to reduce the energy consumption of enterprises and realize the integrated management and control system of energy saving and consumption reduction.

Introduction

The cement intelligent control cloud platform system is generally divided into equipment layer, field control layer, data fusion layer, data layer and application layer. The equipment layer is the actual production equipment and monitoring equipment for the production line of cement enterprise, including production equipment, SCADA, PLC/DCS, intelligent instrument equipment, fault filtering equipment and so on. The field control layer includes field control system for cement production or other intelligent manufacturing systems. The data fusion layer mainly includes soft measurement, conflict resolution, scale unification, redundancy elimination and other fusion tools, which can filter and process the original data and get the correct and effective data. The data layer mainly includes database, control model and database management module. The application layer is responsible for the input of the enterprise user business request and the display of the business results, and it contains the actual business logic, and interacts with the data layer of the background according to the content requested by the user. Application layer is one of the core of the system, including data monitoring module, comprehensive analysis module, control general appearance module, control system module and system monitoring module.

The intelligent control cloud platform system includes data acquisition subsystem, data fusion subsystem, data storage subsystem and client subsystem. This article mainly introduces the design of the client framework and the research of the key technology of the client.

Client Frame Design

In this system, the Web application development framework is proposed for the needs of development and the scene of Web application development. On the one hand, it gives specific specifications for the implementation process of the development project; on the other hand, it designs and implements the front-end development technology framework and the back end development technical framework for Web applications, which can be used in conjunction with the framework of the project process. The development based on the technology framework can avoid a lot of repetitive labor [1]. When developing new projects, there is no need to start from scratch. We only need to develop project specific functions based on existing technology frameworks. The emergence of a technical framework shortens the development cycle and reduces development costs, allowing developers to focus more on
the development of specific software rather than distracting much of the basic part of the development. The cement intelligent control cloud platform client should not only have perfect functions, but also a good client layout. The good layout of the page can show the function of the system in a more intuitive way in front of the user, convenient for users to understand the function of the system, and the user's operation is simpler. At the same time, in order to improve the extensibility and portability of the whole frame, the main navigation bar (first level menu) and the auxiliary navigation bar (two level menu) are all editable, so that the frame can be easily modified without modifying the source. The design of the client page layout is shown in Figure 1.

<table>
<thead>
<tr>
<th>Title Display Area</th>
<th>Leading Bar (First Level Menu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Display Area</td>
<td>Page Tabbed Area</td>
</tr>
<tr>
<td>Auxiliary Navigation Bar (Second Level Menu)</td>
<td>Page Display Area</td>
</tr>
</tbody>
</table>

Figure 1. Client page layout.

**Research on Key Technology of Client**

**Data Real-Time Monitoring Technology Based on Web Service**

The architecture of Web Service is built on three actions based on three roles of Web service provider, Web service requester, Web service broker, and release, discovery, and binding [2].

![Web Service Architecture Diagram]

Figure 2. Web Service architecture.

Implementing a complete Web service includes the following steps.

1) The Web service provider designs and implements the Web service, and releases the debugged Web services through the Web service broker and registers at the UDDI registry; (published)
2) The Web service requester requests a specific service to the Web service broker, the mediator inquires the UDDI registry according to the request, and seeks the service for the requester to satisfy the request; (discover)

3) The Web service mediator returns the Web service requester to the Web service description information that satisfies the conditions, written in WSDL, and all kinds of machines that support Web services can read; (discover)

4) Generate the corresponding SOAP message from the description information returned from the Web service broker, and send it to the Web service provider to implement the call of the Web service; (binding)

5) Web service provider executes corresponding Web service according to SOAP message, and returns service result to Web service requester. (binding)

In a simple way, we can publish a service that sends real-time data on a remote server. When we send a corresponding request on the client, the remote real-time data will be transferred to the client interface.

**Data Transmission Technology of Front and Back Platform in JSON Format**

In the development of the Web program, the selection of the appropriate data transmission and transformation of the client server has an important impact on the efficiency of the development of the system and the efficiency of the program. In the process of design and development of the system, the data transmission of the front and back platform is realized by the AJAX technology of jQuery. The data interaction of the front and back programs is realized by the lightweight data exchange format JSON (JavaScript Object Notation), because the data format is very suitable for the interaction between the server and the JavaScript. In order to reduce the workload in the development process, facilitate the conversion of JSON format data to the C# object (DataTable data), and unify the pre background data conversion protocol, we should do a functional class library that specializes in maintaining JSON data format and C# object data format in advance [3].

![Figure 3. Ajax schematic diagram.](image)

**Chart Analysis Control**

In order to display data to users more intuitively, diagrams often need to be used in this system, such as pie chart, histogram, line diagram and other graphic elements, but the traditional chart controls are
more complicated. Therefore, we’re encapsulate the chart control to make it more suitable for the client and intelligent [4].

This client is designed to use jQuery based free open source drawing plug-in jqPlot. The reason is that it has full function, mainly including a variety of chart styles available, customizable time axis, rotating axis text, automatic trend line, toolbar hints and highlighting data points, default optimal settings in use, etc.

The Interface Technology between Database Subsystem and Other Subsystems.

In order to facilitate access to databases,.NET provides us with a special access class library ADO.NET, but in the process of developing system software, most of them will be further encapsulated on this basis according to their own needs. This system includes multiple subsystems. For those who are unfamiliar with the database table structure, we can customize the unified interface to facilitate the maintenance of the information you want.

Summary

This system strictly adheres to the principle of software design in the process of design, and strives to make the software ensure high cohesion and low coupling, which is beneficial to the maintenance and function expansion of the later software. In the process of software reconstruction, many design patterns are adopted, which makes the system more robust and improves the reusability of system code.

Acknowledgement

This work was financially supported by Shandong province's independent innovation and achievements transformation project (new industry) plan (2015ZDXX0101F01) and Shandong Province major R & D plan (2017CXGC0614).

References


