Analysis of Enterprise Management Information System
Based on Cloud Computing

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Abstract. With the rapid development of Internet technology, many cement companies have gradually realized that the massive amount of information brought by the Internet can open up ideas for enterprise development and improve their economic benefits. This article decomposes the existing cement enterprise management information system hierarchically relying on cloud computing technology, and then discusses the idea of building an enterprise cloud management based on the cloud computing system, which provides a reference direction for achieving efficient and low-cost rapid development of cement enterprises.

Keywords: Cement Enterprise, Management, Information System, Cloud Computing

1. Introduction
Cloud computing is a new type of computing method based on the Internet. It is a development result based on distributed processing (grid computing) and parallel processing. Its main function is to provide users with a variety of application services based on massive data information in a very large-scale distributed environment, using high-efficiency computing capabilities and methods.

1.1. Infrastructure as a service (IaaS)
IaaS uses virtual technology to integrate various hardware resources through the Internet to form a large number of central data groups. It also provides services such as data storage methods, data calculation methods, and data backup mechanisms. This service can be targeted at different cloud users, and be also independent of each other. Due to hardware resource sharing, the cost for usage is relatively low. This layer also lays the foundation for building Platform as a Service (PaaS)[1-2].

1.2. Platform as a service (PaaS)
PaaS generally builds an open software platform on the basis of IaaS. This platform provides tools
such as SDK and IDE (Integrated Development Environment) for free. Software developers can use these tools to build new solutions or extend the existing applications on platform architecture. to meet different customization needs of different users. For example, Microsoft's Azure (Microsoft Cloud Computing Platform) has adopted the PaaS model\cite{13-4}.

1.3. Software as a service (SaaS)
Saas is built on the basis of PaaS and is implemented directly through the software application model provided by the Internet. Users generally do not purchase software and hardware resources, and usually use the services provided by the cloud computing system in a paid or free manner. Cloud users can access cloud computing services anytime and anywhere\cite{5-6}.

In addition, SaaS, PaaS, and IaaS are orientated at different types of users, not forming a complete inheritance relationship (SaaS is based on PaaS, while PaaS is based on IaaS), because SaaS can be based on PaaS and can be directly deployed on IaaS, and PaaS can be built on IaaS or directly on physical resources on different architecture systems must be determined based on different management models.

2. Introduction to cement enterprise management information system
Cement Management Information System (CMIS) is a special software developed for cement enterprises.

The CMIS system is usually built on the Windows 2000 system platform, adopting the B / S structure, and is easy for both an enterprise's decision maker, manager, and specific staff to browse the information they need. It integrates management sub-items such as system management, production, quality, energy consumption, sales, and information query. All information only needs to be entered once in the data source, and other departments can call it when needed, which fundamentally solves the problem of information between departments. The unified and isolated situation has realized the consistency of basic data and improved the work efficiency of each department.

2.1. System characteristics
In the CMIS system, the information resources of each department in the cement enterprise can be shared, which strengthens the coordination of work between departments, achieves the standardization of production process management within the enterprise, makes the work processes of each department standardized, thereby improving the quality of work efficiency.

1) CMIS system can collect real-time data from DCS system. At present, mainstream DCS systems have open OPC data communication interfaces. Considering the safety of the production process, the CMIS system is not allowed to send control instructions to the DCS system. The production management part of CMIS system can provide dynamic display simulation diagram of DCS system data.

2) Enterprise decision-making or managers can view the company's production management information by browsing the enterprise WEB server at any time and at any place, providing managers with reliable and real data information in real time. Enterprise LAN users access the Web server through the LAN, and users outside the network access the Web server through the Internet.
3) The CMIS system can provide managers with complete data reports, such as daily, monthly, annual reports, etc., and provide real-time data query, printing and other functions.

4) Collection and management of the data. It mainly refers to the truck scale weighing management of the cement enterprise. It uploads the data to the CMIS system for providing it to the management by collecting the specific data of each weighing point after decomposing and combining.

2.2. System module division

The overall division of CMIS system modules is shown in Figure 1.

![Figure 1. System module](image)

1) System management. It includes user management, parameter settings, and logging. Among them, user management mainly includes information such as operator’s name and permission assignment; parameter settings include the setting of various basic standard information, such as storage classification, raw material classification, etc.; logging means that the system records operations such as adding, modifying, and deleting core services, including module name, content, operation method, operator, operation time, etc. to ensure the traceability of various system operations., and provides log query functions.

2) Production management. According to the information displayed in the production process, a reasonable production scheduling plan is formulated to facilitate the control of product output and quality. Computers are configured in each relevant department to monitor the production of the entire plant in real time. The scheduling department can complete the scheduling and management of production through the computer of this department.

3) Quality management. Usually only laboratory, raw materials, semi-finished products and other data are analyzed and summarized. The contents of management operations usually include information such as the test table (raw material classification, test time, analysis batch, analysis name, test number, composition ratio) and other information.

4) Energy management. It mainly monitors the comprehensive coal consumption and power consumption of clinker; the comprehensive coal consumption and power consumption of cement. The collected data points include the current, power, and temperature and pressure of the coal-consuming equipment. The energy consumption can be reduced and economic efficiency be improved by
comparing and analyzing the actual energy consumption in the production process with the nationally defined energy consumption value, real-time tracking and timely processing. Some of the analog quantities are listed in Table 1 (the parameters in the table can be increased by themselves, here is an example).

**Table 1. Example of analog parameters for energy consumption**

| Order number | Type | CMIS roll call | Cement mill current | DCS roll call |
|--------------|------|----------------|---------------------|--------------|
| 2            | AI   | AIYLMDL        | Coal feeding at kiln head | Analog variable 2 |
| 5            | AI   | AIRYDT         | Coal feeding in decomposers | Analog variable 5 |
| 7            | AI   | AIYZL          | Coal mill current | Analog variable 7 |
| 8            | AI   | AIYZS          | Kiln speed | Analog variable 8 |
| 9            | AI   | AIMMDL         | Kiln current | Analog variable 9 |
| 10           | AI   | AIFJLWM        | Lift current in the hopper | Analog variable 10 |
| 11           | AI   | AIYTW          | Raw material grinding current | Analog variable 11 |
| 14           | AI   | AISNMDL        | Explain | Analog variable 14 |

5) Inventory management. It mainly includes the information of the raw material to be warehoused, such as raw material classification, invoice number, storage date, quantity, unit price, manufacturer name, specifications and other information. The storage management will involve the data transmission of weighing points (such as floor scales) of enterprise truck scales, etc. After obtaining the gross weight, tare weight and other data from the weighing data collection system and automatically calculating the net weight data, the required data will be set to automatic uploading it to the corresponding data table in the warehouse management module for processing, for raw material management personnel to enter information such as unit price. It also includes operational applications such as outbound information management.

6) Sales management. This module includes procurement of raw material, finished product sales management, etc. The procurement of raw materials includes procurement contract information and supplier management information. The management of finished products usually involves the weighing points such as cement clinker scales and pit scale of the enterprise. The data of the number of semi-finished products, the number of finished products, user information, contract information, charging amounts, and charging time collected by the data acquisition system can be uploaded automatically to the corresponding data table in the CMIS system for the CMIS system to decompose and merge.

7) Personnel management. It includes general management functions such as basic employee information, contract management, and attendance.

8) Information inquiry. The interface performs inquiries in a universal manner, and the contents displayed in the inquiries are printed in a standard report format. ① DCS data query: Through the collection and calculation of the collected data, the management personnel can have a holistic and intuitive understanding of the overall production situation, and query and summarize the production parameters according to the workshop, branch and whole plant, and use tables and graphics. Display; ② Quality information query: mainly query the laboratory for analysis of raw materials, semi-finished products, and finished product content; ③ Energy consumption information query: query for electricity and coal consumption data; ④ Inventory information query: Comparative analysis of raw materials out of the warehouse, Statistical analysis of raw material consumption, query of inventory information (raw materials, semi-finished products, finished products) and other data; ⑤ Sales
information query: query of finished product out of stock, purchase contract and other data; ⑥ Personnel information query: query basic information of employees, contract positions, etc. Information; ⑦ log query: query the records of various operations performed on the CMIS system.

3. Application analysis of cloud computing in CMIS system

At present, the use of such CMIS systems by cement production enterprises is limited to their daily management. Many decisions are still made from a large number of paper reports for summary analysis. The aggregated data is not easy to save, and comprehensive analysis of big data is difficult. The cloud computing system has the advantages of massive data information and efficient computing capabilities. According to the company's own requirements, the required data can be analyzed and summarized by computing methods and analysis tools to provide guidance for decision-making and decision-making policy.

Now based on the content of the CMIS system, a cement enterprise cloud computing system is constructed. However, when actually building a cloud computing system, such enterprises should first formulate a unified standard information management policy by combining their strategic goals, and determining data analysis, and then gradually build the enterprise's framework structure according to the selected cloud computing management software platform.

The cloud computing load is calculated, assuming the input space is $H_i$, and the current cloud computing load is shown in equation (1):

$$L_i = \{cpu_i, mem_i, bw_i\}$$

(1)

It is obtained by analyzing and calculating the historical load sequence $H_i$. The decision function of the cloud computing load prediction model is shown in equation (2).

$$L_i = \sum_{i=1}^{N} (\alpha_i - \alpha_i^*) \prod_{j=1}^{B} \left[ \cos \left( k \cdot \frac{H_{i,j} - H_{i,j}}{a \cdot \gamma} \right) \cdot \exp \left( \frac{H_{i,j} - H_{i,j}}{a \cdot \gamma^2} \right) \right] + b$$

(2)

In (2), $H_{i,j}$ represents the $j^{th}$ element of $H_i$, and $H_{i,j}$ represents the $j^{th}$ element of $i^{th}$ training sample $H_i$. This model makes use of the existing required parameters to obtain the cloud computing load at time $t$ using formula (2).

4. Conclusions

The application of cloud computing to cement enterprises basically realizes a centralized and unified management of data resources and a high degree of information sharing mechanism, which solves the problem of effective combination of investment, energy consumption and information resources. The use of cloud computing system will have important practical significance for energy saving and emission reduction of cement enterprises, cost reduction and efficiency improvement, and core competitiveness of enterprises. However, in the application, it is necessary to analyze the specific enterprise management and system environment of the enterprise to work out a more appropriate operating mode.
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