The Design and Implementation of Information Management System in Laboratory of Petrochemical Enterprises

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ABSTRACT: *Through the actual case of the implementation of the large state-owned oil enterprises, the chemical laboratory information management system construction, from the demand for research analysis is detailed. The system outline design, system detailed design, system testing and system operation maintenance, several aspects elaborated the petroleum chemical industry inspection room information management system design implementation of the method and the process. This paper first analyzes the process characteristics of the operation and management of laboratory, research the internal staff demand, and explains the necessity of the construction of the system; secondly, combined with the laboratory, business needs and business situation, the study analyzed a set to conform to the laboratory work flow characteristics. Third, the laboratory information management system of the specific implementation plan is addressed. again, Then the analysis of the overall structure of the laboratory information management system, detailed design, specific design ideas and methods of database, sample testing process, management process, management reporting, data queries and other functional modulesare studied. Finally, the paper summarizes and analyzes the advantages of the laboratory management information system in the practical application in petrochemical enterprises.*

Keywords: Petroleum and Chemical Engineering, Laboratory, Information System, System Design

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1. Introduction

Petroleum and chemical industry is the basic industry of the country, which plays an important role in the national economy. As an important part of China's national economy, petroleum and chemical industry has made great contributions to the sustained and rapid development of China's economy. In recent years, countries in the refined oil and related products standard formulation, quality control and other aspects of management initiatives are maturing, petrochemical enterprises in the actual operating

process through using new technology, and the new technology constantly improves the quality of the products [1]. Along with the accelerated development of economic globalization, petroleum chemical industry is also facing new challenges: wide sources of the raw materials and components increase in complexity, more kind of products and various ratio increasing many factors influence the petroleum chemical industry must be accurate and high effective and strict management in the quality control and laboratory analysis of business processes, in order to meet the requirements of the business development of the company. In order to improve the quality of the products and improve the work efficiency and management level of the laboratory, petrochemical enterprises have set up a laboratory information management, support for chemical analysis and quality control, laboratory management, and other business requirements. The laboratory information management system, which is established by petrochemical enterprises, meets the needs of the business to a certain extent, but there are still a lot of improvements have to be made. Petrochemical enterprises usually adopt mature commercial software to implement, and function provided by the commercial software often cannot completely meet the users demand. Therefore, it is necessary to provide the configuration software in accordance with the needs of customers' customized development. Most mainstream software adopt three layer architecture, but because most of the laboratories is composed of multiple analysis laboratory group and other management departments, and place of work is relatively fixed, but it also needs to a large number of infrared spectroscopy, chromatography, electrochemical analysis instrument data connection and automatically import. It is necessary to construct the architecture more flexible and convenient to achieve relatively complex transaction processing (see figure 1 and 2).

Figure 1. Laboratory layout (a)

Figure 2. Laboratory layout (b)

2. High-Level System Design

The characteristics of petrochemical enterprises in the laboratory are: overall size is large, complex process, test samples are different, there is test object for the inflammable and explosive dangerous goods, there is deep gap between the level of staff and capacity significantly, and there is effect of traditional management methods and processes, test data and results of needs and the information system integration is notable. Therefore, the laboratory information management system needs a high level of design and implementation. For status and business demand of petroleum chemical enterprise, the laboratory information management system suitable for using is C/s and B/s combination mode, the quality data query system based is on B/S mode, and other applications in laboratory management function modules are used in C/S mode. Software can fully support customer specific configuration settings, including the customer defined fields and tables, and it does not require complex programming to meet the needs of customer testing business, as all functions can be in flexible configuration (see figure 3). At the same time with a comprehensive instrument connection function, it can be easily connected to the laboratory with the existing types of instruments [2].

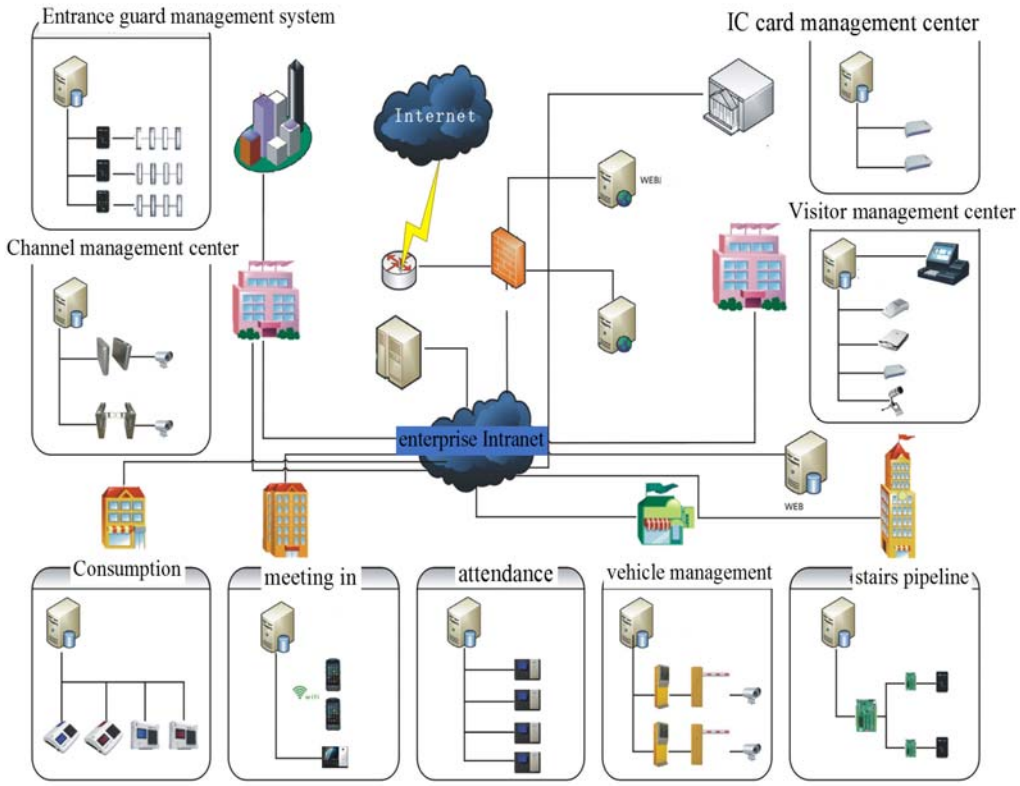

Figure 3. Overall system architecture diagram

2.1 Database model

According to the laboratory samples of raw materials testing business process, the quality inspection department or unit personnel notice laboratory tests. After the division of monitor analysis personnel, manual like Deng, sampling, analysis project assignment of the monitor and analysis personnel project analysis and self checking would be carried out, if not qualified or by other abnormal phenomena, then the officers retest the analysis. If there is no abnormality on duty personnel complex, and if the review results in no abnormal inputs, the results will be analyzed. After the input, the monitor audit judge the abnormal need re-examination or re-sampling. If there is no anomaly by the squad leader, then fill in the account and the laboratory. In the petrochemical enterprises, the quality supervision and inspection of raw materials, finished products and semi-finished products with the quality inspection department (quality safety and environmental protection department) is responsible for issuing the certificate of the product and the audit quality report. Enterprise leadership, production operations, production technology department, and the production workshop all need to query the quality data (see figure 4). Quality inspection departments under the laboratory,operate with the class leader, laboratory analyst, technician [3].

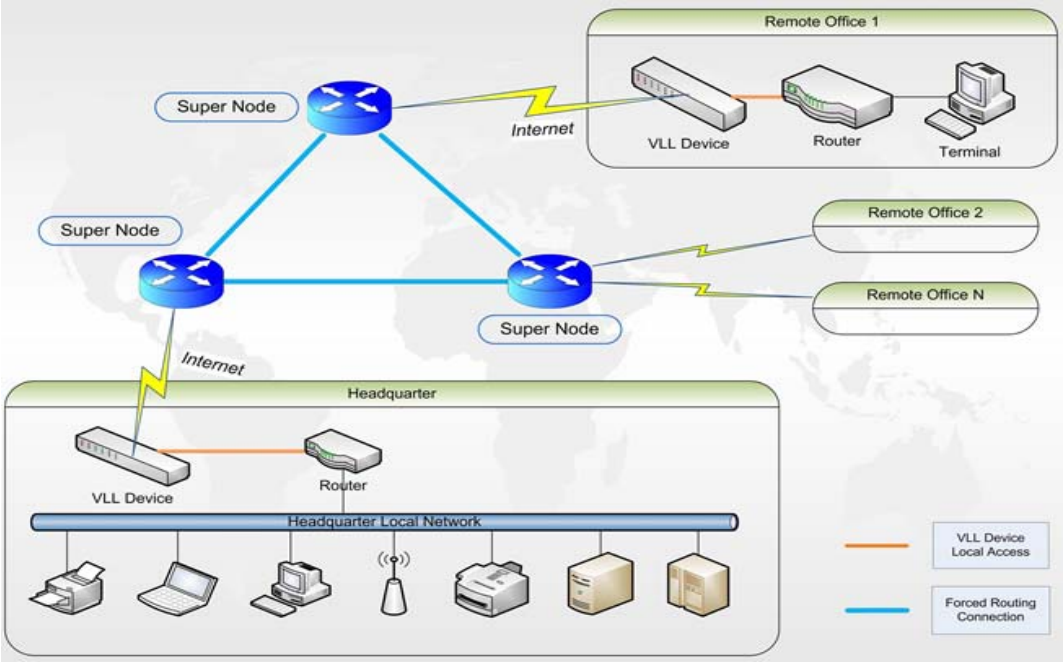

Figure 4. Schematic diagram of system database

2.2 System sample flow calculation

In the configuration of the system, the test program set automatic scheduling program in detail, including time, limited size, composition, cycle, inch, and safety coefficient properties. The cycle of the test plan is as short as once a week and higher than once, a weekly inspection plan requires manual registration of samples. Automatic registration samples need to be completed in the appropriate time according to the requirements set. The system of automatic scheduling program in detail must be with automatic scheduling plan and change, through the automatic scheduling server maintenance, should ensure that the normal state of the server realize the automatic scheduling accurate without any error automatic sample registration. For some reason,

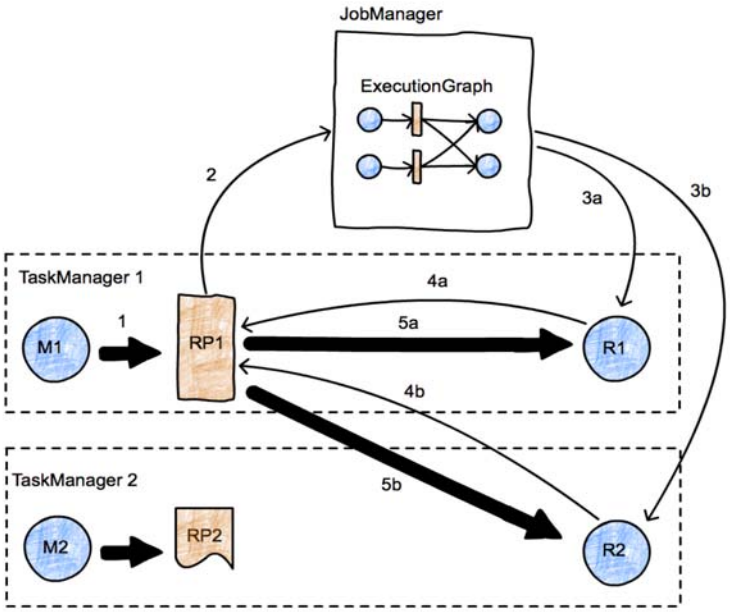

Figure 5. Schematic diagram of system data flow diagram

the automatic scheduling or sample type can not be realized automatically, and the information is needed to input to the system manually. In the input to ensure that the sample has a corresponding uniform format of the unique code identification and text name, manually select the correct corresponding data template, to achieve the manual landing of the sample. The laboratory instrument and equipment connection, realize the automatic collection and data transmission of all kinds of data (see figure 5), unified management and maintenance, and realize the automatic collection and analysis of the test data. System will automatically run the results of the data and the results of the archive.

2.3 Automatic decision level

After receiving the information of the sample, the system will automatically determine the level of the samples according to the set specifications and testing standards. Various rating categories from high to low is divided six categories, as follows: qualified, superior products, first-class products, second-class goods, unqualified and products (or agreement). In order to ensure the consistency of product technical specifications, when the sample component specifications change, it is needed to change the corresponding indicators in the system. If we find that the information is incorrect or the information is released, the data and information should be changed or cancelled. At this point, the monitor by the laboratory in the system to authorize or perform the sample information release cancellation function. In this way, the data corresponding to the test samples will be able to re-implement the results of the input. The quality of the results of data has two levels of audit, the quality of the results of the data level has three audit and the sample data release process [4-7].

3. System design and Implementation

According to laboratory temporary additional samples of laboratory operating procedures, quality inspection department or unit personnel notice temporary sample, device inform QC scheduling, sampling inspection scheduling and notification, after the division of the monitor analysts manually like Deng, according to the division of monitor sampling, project distribution analysis of the monitor and analysis personnel project analysis and self checking, such as unqualified or other abnormal phenomenon is by re analysis personnel; if there is no abnormal is on duty personnel review, if the review no abnormal inputs the results [8-10]. After the input by the judge and monitor audit, such as anomalies need to be retested or re sampling; if there is no abnormal phenomenon by the monitor fill in handing over records or sample account. Finally, technical personnel by the task force confirmed release. According to the test procedure of laboratory samples of the finished product, quality inspection department to notify the inspection plan or unit personnel notice test, sampling inspection scheduling and notification, after the division of the monitor analysts were manually like Deng, according to dispatch notice sampling, analysis of distribution of the monitor and analysis personnel project analysis and self, if not qualified or other abnormal phenomenon is by re analysis personnel; if there is no abnormal is on duty personnel review, if the review no abnormal inputs the results. After the input by the judge and monitor audit, such as anomalies need to be retested or re sampling; if there is no abnormal phenomena account is filled by the monitor, quality inspection and submitted to unit personnel [11, 12]. Through the quality determination, the quality of the issue of the quality of the most inspection towel and reported to the production plant and sales department; unqualified unqualified inspection report issued by the production and operation department [13-15].

4. Conclusion

In this paper, based on the actual case of laboratory information management system design and implementation of a large state-owned petrochemical enterprises, through the laboratory information management system design, implementation, the testing and maintenance process are studied in detail. It is pointed out that the laboratory information management system for petroleum chemical enterprise business process and management efficiency, to enhance the level of significance, for similar system design and implementation has strong practical significance and reference value. This paper elaborated the laboratory information management system in the design and implementation of the main steps and methods, including: system user needs analysis, outline of the system design, system detailed design, system achieve and the late stage of the system running and testing system maintenance work several aspects of content. This system in the actual application process greatly reduces the laboratory staff and management personnel's work load, reduce the testing process and results of repetition, saving the usage of raw materials, improve the work efficiency and management level of the laboratory. Laboratory information management system through technical means strict the standardized laboratory operation and management process. The management system to be implemented, so that the whole process of some of the responsibility to implement and the system do well documented, the laboratory of the three levels of audit management mode more standardized, operable, improve the overall efficiency and the automation level of the laboratory. Various types of data correlation ratio, ensures the effective protection of data accuracy. Through the system setting, the combination of all kinds of related data, in the system will automatically compare, to effectively

avoid the data input errors or other factors caused by the data distortion and time delay. In the traditional laboratory, the staff need to manually analyze the results of the test or use the computer to carry out a simple data analysis and processing. In this process, the entire laboratory work flow is split into several separate steps, between steps only simple data input and output relationship and in the manual input and output process tend to data distortion, input time delay, repeat each other input problems exist, thus appear inaccurate test results and test steps repeated and repeated laboratory and so on.

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