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Application of Land Engineering Big Data Platform in Laboratory Management

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Abstract: Land engineering big data is the use of big data thinking, methods and technologies to solve specific problems in the field of land engineering, and it is of great significance to promote continuous innovation in land engineering. Throughout the development process, we must understand the geological environment, climate temperature, and what kind of topography and land forms we are in, so as to avoid hindering the progress of land development work due to the influence of these problems. To fully understand these factors, it is difficult to complete it only by relying on traditional database information, and the information obtained is not sufficient. Therefore, the introduction and application of big data is a necessary way for development. Using big data for detection, we can conduct in-depth research on the land in the area to be developed and obtain more reliable data for reference. Use advanced scientific instruments and equipment to sample and analyze the local soil, and monitor the pH, water content and other values in real time. The recorded results are transmitted to the control center in a certain way, and the technical researchers of the center can build a database through these data, and then make a data analysis and judgment through cloud computing to determine whether the land in this area is It is suitable for development, whether it meets the relevant requirements of the country, and whether it will have a bad impact on the surrounding environment after development.

Keywords: Sample testing; land engineering; database; big data.

1. Purpose meaning

Scientific research and engineering projects in land engineering require related testing and analysis of soil materials, and the establishment of sample testing laboratories has effectively improved the general exploration efficiency of land engineering (Lin Hanqing, 2020; Liu Jucai, etc., 2020). The traditional office portfolio can easily deal with the needs of a small amount of business data management. For the rapid development of business-oriented inspection services, a large amount of data is generated all the time. The drawbacks of manual management of these business data are gradually becoming prominent, the main performance is In important work links, the degree of informatization is not high, the lack of a unified data management system, and the efficiency of information reuse needs to be further improved[1].

Based on the laboratory business process LIMS platform, it is planned to use the B/S architecture and the UI layer, business logic layer and data access layer are independent of each other[2]. From the business logic, the system is divided into a detection business module, a resource management module, and a quality system control module. The detection business module realizes the automatic flow of information of the detection business. The resource management module realizes the comprehensive management and development of information resources such as laboratory staff, equipment, customers, and standard documents. The quality system module manages the laboratory's testing index system[3].

The Laboratory Information Management System (LIMS) is the result of the scientific development of laboratory management. It is the product of the combination of laboratory management science and modern information technology. It uses computer network technology, data storage technology, fast data processing technology, etc. to carry out laboratory A comprehensively managed computer software and hardware system (Yu Lianfeng, 2013). Use the LIMS platform to realize a network from sample reception, commission application, testing division, task assignment, experimental result entry, report issuance, and related activities (management of personnel, equipment, reagents, waste, etc. and quality control and quality management) Office functions, to achieve refined management, to achieve the purpose of paperless office, to improve management efficiency; to achieve automated information flow processing for the approval information in the laboratory's testing business process; to achieve data through integrated development with other instruments and systems Sharing, mechanized and intelligent data collection and online editing to generate test reports for users to read and modify; data integration with other application systems in the intranet (office automation systems, etc.) to achieve data sharing and effective use,

and better provide true and accurate products Test results[4].

Realize quantitative management: LIMS can provide statistical analysis of various information of the entire laboratory, such as equipment utilization rate, maintenance rate, workload of workers in different positions, error rate, distribution characteristics of commissioned sample test items, and various tasks of the laboratory throughout the year Information about the time distribution status, reagent or expense consumption law and other information[5]. The management can quantitatively evaluate the working status of each link in the laboratory, and well realize the comprehensive quantitative management of experimental work[6].

2. Element selection

The LIMS system follows the ISO/IEC17025 laboratory standardization management specification, and its functions fully cover the management elements and technical elements of ISO/IEC 17025 (Wu Gang, 2005; Hou Zhichang, 2009). The implementation of the LIMS system will greatly improve the work quality and efficiency of the laboratory, promote the standardized management of the laboratory, help the laboratory establish a complete quality system, and lay a solid foundation for laboratory certification and accreditation (Zhang Xu, 2016; Gao Suping, 2007).

The management system elements of the ISO/ICEC17025 standard are divided into 25 elements of management requirements and technical requirements.

15 elements of management: 4.1 organization, 4.2 management system, 4.3 document control, 4.4 requirements, review of bids and contracts, 4.5 subcontracting of testing and calibration, 4.6 procurement of services and supplies, 4.7 customer service, 4.8 complaints, 4.9 no Compliance with inspection and/or calibration work control, 4.10 improvement, 4.11 corrective action, 4.12 preventive action, 4.13 record control, 4.14 internal audit, 4.15 management review

10 elements of technology: 5.1 general, 5.2 personnel, 5.3 facilities and environmental conditions, 5.4 verification of testing and calibration methods and methods, 5.5 equipment, 5.6 measurement traceability, 5.7 sampling, 5.8 disposal of testing and calibration items, 5.9 testing and calibration Assurance of result quality, 5.10 result report.

3. LIMS system commissioned inspection process

1. Sample registration:

Two registration methods are supported. One is to fill out the "Sample Registration Form" for foreign customers through the Internet page (access to the web page of the public IP address), and the other is to fill in the "Sample Registration Form" at the laboratory site (login to the LIMS system in the LAN).

2. After the sample is registered, the system will generate a barcode, print it and affix it to the sample bag/bottle. The subsequent sample circulation and sample query will support the scanner to read the barcode and obtain sample information.
3. Task Assignment:
The system realizes the automatic assignment of inspection tasks according to the authorization of the personnel (the corresponding relationship between the inspector and the inspection item).
4. test sample:
When filling in the test results for the sample test, you can connect to the instrument through the interface to automatically obtain the test results.
5. Data validation:
When the sample is checked, the system will call the "test standard-limit value maintenance" to give an over-standard color warning for the over-standard test results.
6. Report review
The report reviewer fills in the test results, and the system will automatically generate a "test report".
7. Report issuance
After the confirmation report is issued, the test report can be printed online (the print format can be adjusted).
8. Process visualization
In the sample query, you can view the flow of the sample process (the flow chart is displayed intuitively, the link that has been transferred/the current link/the next link of the process).

4. Scientific research experiment process

1. Experiment application: Applicants fill in the "Examination and Approval Form for Experimental Equipment Application", and use the graphical mouse click method to make appointments on the machine, which is intuitively displayed and easy to use.
2. Experiment approval
3. Training assessment
4. Associated with the personnel's operating certificate, if there is no certificate, training and assessment are required.
5. Experiment process, data archive
Experiment acceptance, fee settlement

5. Scientific research project management

Supports uploading of field detection data to the server, in the form of pictures or videos.

1. Workload statistics: statistics on the workload of personnel and departments over a period of time, including statistics on the number of samples tested, testing fees, and equipment hours.
2. Statistics of scientific research achievements: statistics on the achievements and output of personnel and research groups over a period of time.
3. Test item statistics: Statistics on the distribution of test items accepted for a certain period of time, test fees, etc.
4. Instrument usage statistics: statistics the load of the instrument over a period of time, including the usage time, base load, etc.
5. Quality control statistics: statistics the qualified rate of quality control of personnel and departments over a period of time.

The above statistical analysis function will help the laboratory management to quantitatively evaluate the working status of each link of the laboratory, make scientific decision-making, and achieve comprehensive quantitative management.

Big data is the product of the rapid development of modern science and technology. Big data has many types, huge data volume, and fast transmission speed. It has a wide range of applications in many fields. Big data also has a wide range of applications in the field of land engineering[7]. Experts have paid wide attention. Although the application of big data in land engineering is in its infancy, its development speed is still very alarming, which is of great significance for promoting the sustainable development of land engineering[8]. Some achievements have been made in the application of big data in the field of land engineering, but because the subject of land engineering is still in its infancy, the integration of land engineering industry and big data is not close enough, innovation is not enough, data cannot be effectively shared, and the big data system is still Unestablished, the lack of professional and technical personnel in the industry has affected the development and growth of the land engineering industry to a certain extent[9].

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