Analysis of Integrated Processing System Design in Remote Sensing Surveying and Mapping Data Based on GIS Technology

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ABSTRACT

Research on integrated models for remote sensing data has become increasingly sophisticated, and the applications have grown more diverse and comprehensive. There are significant variations in remote sensing data integration models, and in the practical application of these models, there is a diversity of issues, including low efficiency in data processing systems. This paper briefly explores the design and construction of a data parallel processing framework for remote sensing surveying and mapping data processing systems based on GIS technology, and visualizes the data model for easy observation, which is beneficial for further applications in remote sensing surveying and mapping data and can be extended to multiple fields.

KEYWORDS

GIS technology; Remote sensing surveying and mapping technology; Data processing integration

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1 Introduction

In recent years, with the rapid development of remote sensing technology, the practical application of remote sensing data has become increasingly diverse and widespread. Data information based on GIS technology exhibits diverse characteristics such as multiple formats and rich content. Rapid integration and processing of data have gradually become a critical component in the development of remote sensing technology. The design of a remote sensing surveying and mapping data integration processing system is closely related to basic hardware configuration, involving the design of mediators and wrappers. The application of mediators allows for the rapid transformation of data, making data integration more effective and realistic, and facilitating independent data transfer between local data sources, thereby improving data integration processing efficiency. The design of wrappers utilizes the core functions of the server to transmit critical data from remote sensing data sources to the executor through function calls, playing a crucial role in the auxiliary processing of remote sensing surveying and mapping data. In addition to hardware, software design is also of utmost importance. This paper primarily analyzes the software system related to remote sensing surveying and mapping data integration processing based on GIS technology, aiming to contribute to the improvement of the operational efficiency of data integration systems.

2 Preliminary Analysis of the Design of Remote Sensing Surveying and Mapping Data Integration Processing System Based on GIS Technology

(1) Designing a GIS-Based remote sensing surveying and mapping data integration model

Leveraging the advantages of GIS technology in designing a comprehensive integration model involves using XML tools for data transformation to achieve the goal of structured data integration and application. In the practical application process, one can initially acquire accurate remote sensing surveying and mapping data and utilize GIS technology to correspondingly transform this data, constructing a three-dimensional model. Subsequently, the model can be stored based on the actual information content acquired, facilitating the integration objectives for various subsequent processing tasks. The design of the entire data integration model encompasses a variety of content, especially the interface, drivers, and core components, which are crucial.

The middleware design in the interface section can standardize and drive the device configuration library and acquire information according to the requirements from function libraries. The core middleware section, on the other hand, modifies the data acquired by monitoring subsystems according to the requirements conveyed by the application layer. Commands conveyed by the upper layers of the integrated model software system can be read and obtained in the intermediate stage, enabling the initialization of device interfaces by the staff and utilizing data acquisition functions to retrieve key data content from specific remote sensing data, building a database, and transmitting the database system to the application layer.

When it comes to storing unstructured remote sensing surveying and mapping data, Excel spreadsheets are typically employed. During the surveying and mapping process, it is often challenging for staff to determine the value and importance of the acquired data. Therefore, in practical applications, specific requirements from the application layer are used to obtain key information content from remote sensing surveying and mapping data and save it. Different strategies can be devised for data integration under different file format backgrounds, further forming attribute templates. In practice, the extraction of non-structured data requires categorization based on key attributes, using appropriate methods to complete the data classification task, and subsequently employing GIS technology to transform different remote sensing data information, thereby completing subsequent operations.

(2) Integration system design results

After obtaining remote sensing surveying and mapping data, it is necessary to establish a data parallel processing framework. The entire framework utilizes load balancing algorithms as its foundation and employs dynamic scheduling algorithms to clearly manage node configuration and user connection details. In practice, the capabilities and extent of data processing vary among the servers used for remote sensing surveying and mapping data acquisition and processing. Therefore, it is essential to configure the servers based on the actual circumstances, taking into account the task request connections for each server and obtaining server load information.

Following the application of the remote sensing surveying and mapping data integration processing system, ARC GIS software can be used to process the data, generating regular visual grids and converting them into tangible products. Subsequent analysis and research can be conducted through a GIS platform.

3 Testing of the Remote Sensing Surveying and Mapping Data Integration Processing System Based on GIS Technology

(1) Preparations for system testing

In order to ensure the stable operation of the remote sensing surveying and mapping data integration processing system based on GIS technology, as well as the accuracy and efficiency of data production, it is essential to conduct specialized testing of the system. During testing, a designated open area can be used to acquire remote sensing surveying and mapping data, which will serve as the test data for evaluating the system's reliability. After obtaining relevant data, the use of GIS spatial technology can generate corresponding three-dimensional models.

(2) Real-Time testing of remote sensing surveying and mapping data integration processing

During the process of organizing testing for the remote sensing surveying and mapping data integration system, it is crucial for staff to monitor the specific status of system testing in real-time, ensuring the real-time acquisition of integrated data and understanding the changes in data volume. Based on the experience of technical personnel, data integration platform can be used to build scenarios of varying data volumes, as shown in Figure 1, indicating the average time consumption for different data volumes and their relationship. The analysis reveals a connection between the average time delay of data integration processing and the amount of data processed in a single instance. As the volume of data to be processed increases, the average time delay decreases accordingly. However, when the number of data points exceeds 200, the degree of variation in the average time delay decreases, gradually stabilizing. During the process of surveying data integration, data is continually updated and transformed, which inherently incurs a stable time cost. Therefore, when the data volume is small, the system's startup time becomes greater. It is only when the data volume increases that the average time delay becomes representative.

In summary, the specific results of system testing suggest that implementing data integration tasks and objectives within a relatively small scope is more likely to be achieved in the experiments of data integration processing.

(3) Multi-Task Testing of data integration processing system

During the testing and operation of the data integration processing system, the remote sensing surveying and mapping data system can be divided into different tasks, and the size and content of these tasks can be arranged. Task priority can be determined based on the real-time analysis of data integration. The idea behind multi-task testing is to initially not set task priorities, allowing the system to execute multiple tasks simultaneously at the same time to obtain data. During the comparative testing of the average time delay in the data integration processing system, it is found that the processing times for different tasks vary significantly. In other words, this processing system lacks real-time effectiveness. Specifically, when multiple tasks are executed simultaneously in the system, only two tasks can be completed at the same time, which results in irregular processing in the surveying data integration system, leading to higher average delays and lower data processing efficiency. Setting different priorities for tasks is the next step, conducting experiments in the same mode to obtain statistical data. It is found that tasks set as priorities receive preferential treatment. This prioritization allows for more timely and precise processing of remote sensing surveying data, making it more effective and valuable for practical applications. It can also be extended to other fields.

4 Conclusion

In summary, as advanced technologies and equipment continue to emerge, remote sensing surveying and mapping technology, as a highly modernized technology, has been widely used in various fields. Data obtained through remote sensing surveying and mapping technology is of great value in integration and application. Simultaneously, data integration processing is a key issue. This analysis of the design of the remote sensing surveying and mapping data integration system based on GIS technology can provide support for the effective application of acquired remote sensing surveying and mapping data, emphasizing real-time capability and higher system efficiency. However, there are still areas for improvement in this design regarding the integration and processing of remote sensing surveying and mapping data, leaving room for further refinement in the future.

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References

[1] Dongling Wu. Xinjun Liu. Diversified intelligent coal mine monitoring data integration solution and technical implementation [J] Coal Technology, 2023,42 (07): 213-16.

[2] Min Zhang. Yongbo Su. Nan Wang. Li Yang. Fang Yang. Research on Fast Conversion Methods for BIM and GIS Data Integration [J] Journal of Xuzhou University of Engineering (Natural Science Edition), 2023,38 (02): 63-70.

[3] Chunmeng Zhang. Analysis of power grid planning visualization system based on multi-module data integration [J] Microcomputer Applications, 2023,39 (06): 182-84.

[4] Daijun Wang. Tiantu Zhou. Junmin Fu. Xing Chen. Shuai Lu. Zheng Yu. Research on the Integration of Multi source Heterogeneous Data in Large Bridge Health Monitoring System [J] Sino foreign Highway, 2023,43 (02): 100-06.

[5] Tianxi Chen. Design of Remote Sensing Surveying and Mapping Data Integrated Processing System Based on GIS Technology [J] Jingwei Tiandi, 2022, (06): 31-33.