Research and Development of a Land Resource Management Information System Based on Multi-Dimensional Information Fusion

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Abstract:Research and development of a land resource management information system based on the multi-dimensional information fusion is studied in the manuscript. Information fusion as a multi-layered, multi-faceted, and multi-level process that involves the detection, correlation, combination, and estimation of data from multiple sources. In this study, the fusion model is integrated to make the land resource management information system efficient. Information resource management needs not only hard information technology as a theoretical support, but also soft management methods as a means. The application is defined and studied for improving the efficiency.

Keywords: Information fusion, multi-dimensional data, land resource management, information system

1. INTRODUCTION

The management of information resources begins at birth. It is inseparable from the management information system. Many researchers believe that one of the reasons for the emergence of information resource management is that due to the high failure rate of early information systems, purely technical management can not solve problems of information systems.

Therefore, people turn to resource management models to manage and control information system. Urban management and planning involve many elements and complex matters, which include not only the spatial information data of the spatial location of geographic objects, but also attribute data reflecting some other characteristic information of geographic objects. Therefore, the construction of such a large and also sophisticated system is particularly complicated. Existing attempts to build the webGIS-based soil resource information system organically combine soil resource information with geographic information systems, build a large spatial attribute database, and use computers to query, retrieve and count soil resource information with geographic characteristics and the operations such as soil characteristics analysis and suitability evaluation. According to the related studies, the applications can be understood from following aspects:

(1) Application in the disaster monitoring. The geographic information system can be used to then manage, query, and analyze information, determine the scope of the disaster, and determine the best route for the distribution of disaster relief materials so that victims and property can be safely and also effectively transported.

(2) Urban road traffic. Three-dimensional spatial geographic information, which enriches the means of solving traffic jams, can be obtained with the established system.

(3) Based on the division of water body functional zones and the analysis of the water environment status quo, such as the water quality target of the river section, the total amount of pollutant discharge and control, combined with the economic development situation, the pollution load of each level year is predicted, and the constraints such as the operation and also regulation of the reservoir, the water level and flow of the river are well considered, and the numerical value is used. Simulation means to evaluate the water environment.

(4) Dynamic monitoring of the water resources, or tracking monitoring, is mainly used for malicious water resources incidents, illegal groundwater extraction, overexploitation, substandard sewage discharge, sudden pollutant leakage, and so on, to predict, analyze and evaluate the consequences of water resources incidents, and provide scientific basis for event management.

In the Figure 1, the sample is presented and then in the next sections, the details will be discussed in detail.
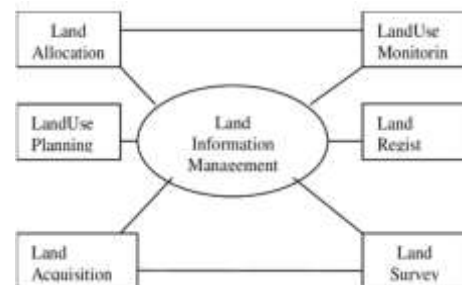

Figure. 1 The Land Information Management Nexus (Figure from: https://www.researchgate.net/figure/The-Land-Information-Management-Nexus_fig1_325455145)

2. THE PROPOSED METHODOLOGY

2.1 The Development of a Land Resource Management Information System

As an important technical support of modern geography, GIS has strong functions of the data acquisition, access, and processing. The integration function of the GIS will play an increasingly important role in resource information systems. The emergence of information resource management stems from rapid increase of information and the rapid development of information technology; while formation of management information system is the application and development of the information technology in the general organizational business management. Therefore, the emergence and development of the information technology is the common basis of the two disciplines. From the perspective of the information resource

management, information resource management is a management theory and method based on the information technology. Since birth of information resource management, the use of information technology for the development and construction of information systems has been one of its essential characteristics.

Information resource management needs not only hard information technology as a theoretical support, but also soft management methods as a means. In the current environment of the rapid development and popularization of information technology. Compared with other management methods, we have many incomparable advantages by building a city management information system, such as: it can prepare and provide information in a unified format, and simplify various statistical tasks. Reduce information costs; provide timely and comprehensive information with different requirements and different levels of detail. To quickly analyze and explain phenomena, and produce comprehensive control in time; it can comprehensively and systematically store a large amount of information, and can quickly query and synthesize. For the design of the system, we should consider listed aspects:

(1) Use consistent map tiles, map projections, geographic coordinates, scales, norms, standards, encoding and data formats, metadata standards, and normalized underlying geodatabases in system design.

(2) Guarantee the data stability, security, error detection and correction capabilities of the system.

(3) Make full use of the resources and technical advantages of the integrated environment, such as multi-source information integration technology, multi-language integrated compilation technology, multi-system function integration technology, multi-platform system integration technology, and distributed application integration technology in the network environment.

In a multi-user system environment, the system architecture plays a key role in data sharing, concurrency, and consistency. From a design perspective, the current architecture design can be summarized as "server-centric" and "client-centric". In our designed system, this will be considered as the framework.

2.2 The Integration of the Multi-dimensional Information Fusion

Information fusion is the process of processing information from multiple sources at multiple levels, each with a different level of information abstraction; information fusion includes detection, association, correlation, estimation, and also the combination of the information. Information fusion research originated from sonar information fusion research in the 1870s. Later, it was extensively studied in the military field and played an important role in the military C3I systems of the various developed countries. With the increase of research and application, its research and application have already expanded to various fields, such as traffic control, medical diagnosis, robot navigation, security control, and other fields.

The key to information fusion is to correlate information data from multiple sources and then use appropriate methods to seamlessly integrate the data in each cluster. The multi-source information fusion technology we use is a computer technology that automatically analyzes and synthesizes information observed by multiple sensors from different information sources according to certain criteria to obtain information that no single source can provide. Information

processing technology that synthesizes valuable information and ultimately accomplishes its ultimate mission.

3. CONCLUSION

Research and development of a land resource management information system based on multi-dimensional information fusion is studied in the manuscript. The model design of information fusion system is the key issue of information fusion, which has direct impact on the structure, performance and system complexity of the fusion algorithm. This paper gives the combination of the technologies to construct the efficient resource management information system. In the future study, the different applications will be considered.

4. REFERENCES

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