# Development practice for 2D and 3D conjoint geographical information system with an example of Jidong oil field

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**Abstract:** with a case of Liuzan oil production operation area in Jidong oil field, we develops out a suite of 2D and 3D conjoint geographical information system of oilfield production management, which adopts Client/Server mode and Browser/Server mode two-layer structure to realize management, edit, renewal, browse and query, information statistics, layout design, drawing and others for fundamental geography data, oil and water well, station yard, road, power and various pipeline data of oil field production, realizing informatization and 3D visualization of field management. At the same time it has distance and area measurement, buffer analyses, superposition analyses, thematic analysis, pipeline section analyses, pre-warning analyses, closing-valve analyses and other two-dimensional analysis functions and three-dimensional roam, browse and query, statistical analysis, route flight, planning and design, earthwork quantity calculation, intervisibility analyses, topographic profile and other three-dimensional functions.

**Keyword:** geographical information system, 2D and 3D combination, Jidong oil field

## 0 Introduction

As a kind of special management system, with the basis of spatial data, geographical information system can carry out superposition analyses for spatial data and attribute data, can realize computer management, fast search and aid decision making information analysis of infrastructure information and will supersede traditional paper map, file sack data management and manual labour mode. It enhances management efficiency, realizes scientization, standardization and automation of oil field infrastructure information management, furnish various thematic map in time and exactly and realizes simple query, synthetic query, statistics and other auxiliary management and information for decision making. It can realize intuitionistic demonstration and a variety of analyses of virtual three-dimensional realism and furnish a kind of convenient and fast analytical approach and information support for leader's decision. As a technique system of supporting digital acquisition, management and application of information, along with very fast speed development of computer technology, space technology and present information infrastructure, its significance increases steadily in economic informatization course. Especially nowadays raise of “digital earth” concept, it makes people have a deeper understanding for GIS significance, which has already extensively been used in various domains and has generated huge economic and social benefit. Writer of this article and other persons adopt the series products of ESRI corporation and Beijing Lingtu corporation's VRMap platform and attempt to develop out a suite of 2D and 3D conjoint geography information management system of Liuzan oil production region in Jidong oil field.

## 1 System objective

It compiles a fundamental geography plot in oil field scope via landform map numeralization and aerial surveying orthograph image and uses digital elevation model to fabricate oil field three-dimensional geography model. Combined with oil gas gathering system, water supply, affusion system and sewage system, power distribution and supply system, communication system, road system, oil and water well system and other oil field surface works data, it appends oil field ground installation, connects corresponding attribute database and develops 2D and 3D conjoint field management information system. It can realize informatization and 3D visualization of oilfield management, can carry out relevant message edit, modification, query, statistics, drawing, 3D route flight and others, and possess definite professional analyses functions so that administrator can conveniently query a variety of terrain information to furnish fast decision service for oil field planning and design.

## 2 System structure and function

It is main purposes of geography information management system of Liuzan oil production region in Jidong oil field to furnish fundamental geography data, remote sensing image data, various special thematic data and other detailed, intact and precise data file for oil field exploration, development, productive construction and furnish fast, exact and detailed basic information gist for administration section to make planning and design and decision. Main content of system is formed by information data, thematic information data and remote sensing image data, which can carry out data browse, data query as well as graph output and others and can also carry out mutual search, spatial analysis and others of spatial data and attribute data.

### 2.1 System structure

System structure adopts 2D and 3D conjoint management system structure and take full advantage of profession, utility, small data amount and other merits of adult bidimensional geography information system, combined with intuitionistic feature, macroscopy, convenient demonstration, three-dimensional analysis and other functions of 3D geographic information system, to realize a practical management system easy to use. System adopts Client/Server and Browser/Server mode with two-layer structure, with database using large commercial database SQL Server, convenient for managing great capacity of spatial and attribute data ( FIG 1) . At the same time it uses adult professional analyses functions of 2D GIS software to realize superposition analyses, buffer analyses, peripatric analysis, trace analyses and other spatial analysis functions as well as bursting tube analyses, closing valve analyses and other deep hierarchical network analysis. 3D part is suspended to connect with client end of client/server modal to realize three-dimensional roam browse, query statistics, aligning flight, planning and design, three-dimensional analysis and other functions.

### 2.2 System functions

System is divided into two parts of three-dimensional function and two-dimensional function. Figure 1 shows the system structure and realized functions.

3D function is developed by using VRMap SDK, mainly realizing three-dimensional

roam, browse query, statistical analysis, route flight and other functions. According to the industry demand, it develops definite three-dimensional analysis functions (distance, area, excavated volume, intervisibility analyses) and others.

Three-dimensional function can be installed as a separate system, also suspended to connect with two dimensional client end as one submodule.

Two dimensional part adopts Client / Server and Browser / Server conjoint mode to build-up a resource sharing, flexible extended and practical GIS system.

In the server end, mass data (including graph data, attribute data as well as image grid data and others) imported by ArcInfo are uniformly stored in large database (SQL Server), managed by using ArcSDE. Then data is released on Internet / Intranet by means of ArcIMS.

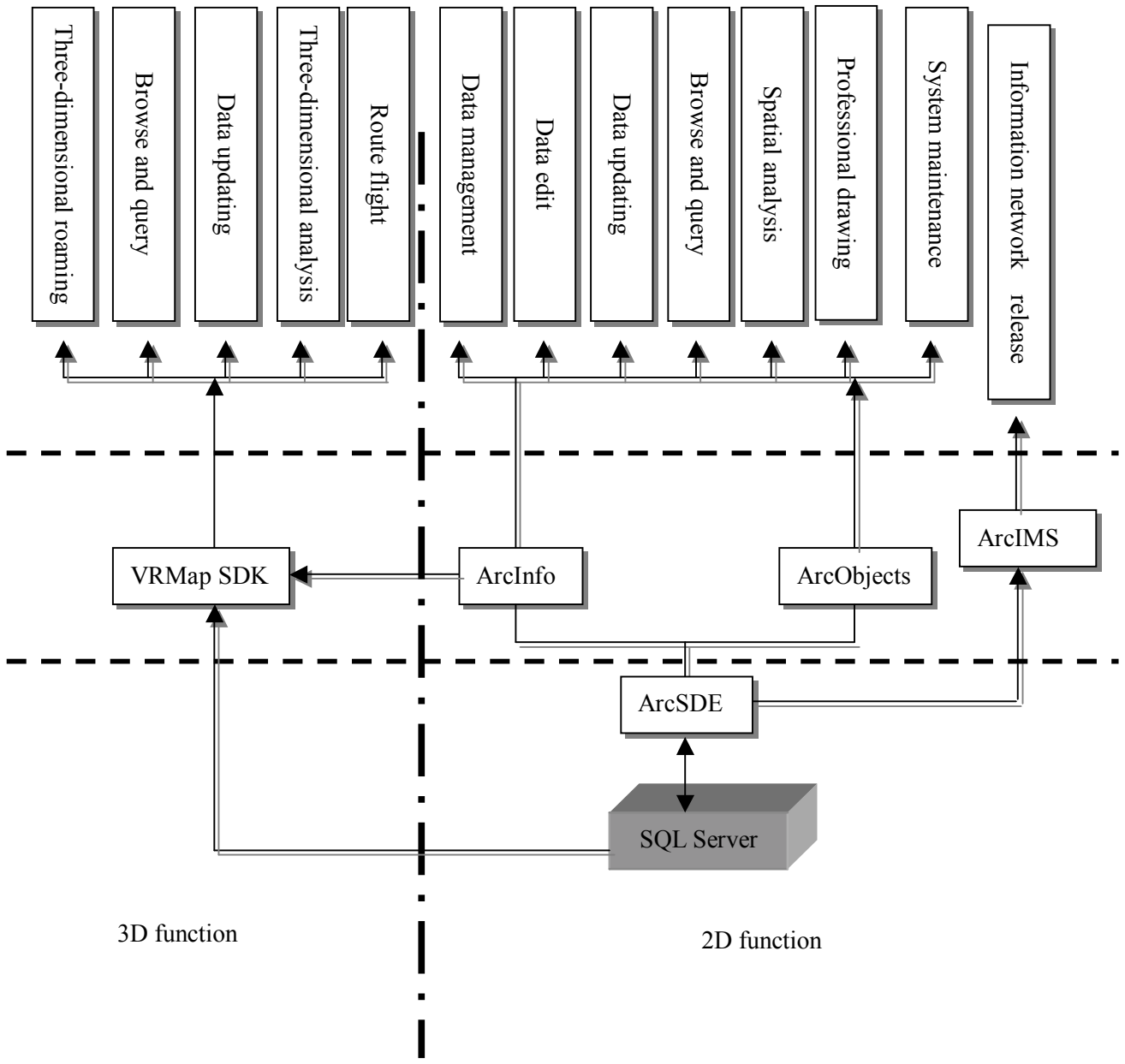


**Fig. 1 system structure and function**

Client end can be configured with difference hierarchical software according to difference demand. For the section office where only simple browse and query are required, based on B / S mode, it is not necessary for client machine to install GIS software, only needing to use universal IE browser to observe data released by ArcIMS; For the division to demand high-class space treatment, to carry out data maintenance and renewal for space database and to realize query and analyses functions at the same time, then it is based on Client / Server, demanding ArcInfo as its application platform. At the same time the quadric development is performed on the basis of ArcObjects to realize interface customization and professional analyse functions and to develop out a GIS system of meeting user custom and professional technology demand.

On the basis of ArcINFO, two dimensional client end uses VB to develop Dynamic Link Library, which realizes customization and expansion of ArcMap function. It also realizes data management, edit, renewal, browse query, information statistics, plate making and graph output and others of plane fundamental geography data, thematic map data ( oil water well thematic map, joint station thematic map, oil gas factory thematic map, oil depot thematic map, road bridge thematic map, platform thematic map, power thematic map, pipeline thematic map and others) and furnish two-dimensional graphs conforming to format requirement for three-dimensional part so as to match the model in three-dimensional module to realize three-dimensional visualization. At the same time it realizes definite spatial analysis (space query, space quantity calculation, reclassification, buffer analyses, superposition analyses and others) . Aiming at the concentrated transmission of oil gas, water supply, affusion, sewage pipe network system, it develops out the analyse function of pipe network profession (section analyses, prewarning analyses, bursting tube / leak and closing valve analyses, (region) of impacting user and others) (Fig. 3). Web release subsystem is developed using java on ArcIMS. Combined with ArcSEDE and SQL Server development, it realizes to release network GIS map, data and metadata to network users.

**3 Epilogues**

The developed 2D and 3D conjoint geography information management system of Liuzan oil production region of Jidong Oilfield has already been plunged in-service use and plays an important role in productive development management and planning of the oilfield. Administrator can conveniently query a variety of terrain information and furnish the fast decision service for oil field planning and design at the same time. It is hoped that development of the system will be able to furnish definite reference action for other industries.

**Reference:**

Yuan Xiangru, Gong Jianya, 1997, design and realization of geographic information system of seamless connection of vectogram and master database with World Wide Web, Journal of Wuhan technical university of surveying and mapping, 22 ( 3).

Song Guanfu and others, 1998, research and development of subassembly type geographic information system, Journal of Image and Graphics , 4.

Wu Xincai, 1998, basic technique and development trend of geographic information

system,Earth Sciences , 23 (4) .
Chen Shupeng, Zhou Chenghu and others. 2000, “Geographic Information Systems: An Introduction”. Science Publishing House. Beijing.
Wu Lun, Liu Yu, Ma Xiujun, Wei Zhongya, Tian Yuan, 2002, method and application of geographic information system principle,Science Publishing House.