GIS System Gas Analysis

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***Abstract*—This paper introduces the overview of GIS system development, composition, and the importance of building GIS systems, objectives, functions, role. And further describes the GIS system in the gas industry and application.**

Keywords- GIS system; Gas

I. CITY GAS PIPELINE GIS SYSTEM OVERVIEW

The so-called GIS system is short for Geographic Information Systems. It is a kind of computer systems to collect, store, manage, analyze, display and apply geographic information, and a General technology to analyze and deal with a mass of geographic data . And it is a burgeoning interdisciplinary subject concentrating computer science, geography, Surveying and mapping remote sensing science, environmental science, urban science, space science, information science and management science. The gas pipeline network is an important part of urban construction; it is of consequence for urban safety and the development of the gas industry to construct gas GIS system and to strengthen the management of gas pipeline network information.

II. DEVELOPMENT OF GIS SYSTEM

At present, the GIS System is widespread used at home and abroad, not only successfully utilized in the fields of mapping, cartography, resources and the environment, but also has become an important tool for urban planning, public facilities management, engineering construction.

CGIS was established in Canada since the 1960s for the first time; Dr. Tomlison put forward the concept to geographic information system in Canada. In the early 1970s, the United States brought out two famous GIS system, which are the ARC / INFO developed by the United States Environmental Systems Research Institute (ESRI) and TIGER system developed by the U.S. Department of Commerce, Bureau of the Census. With 30 years development, the structural design of database, the management and analysis of spatial data and GIS General Software have developed into a more mature system.

Especially since the 1980s, GIS software gradually commercialization has appeared in ARC / INFO, SYSTEM-9, INTER GRAPH, GENAMAP large GIS software and The SPAM, ILWIS, MAPINFO, ATLAS, and other small and medium-sized software widely used in land evaluation, soil erosion control, water resources survey and management, socio-economic planning, disaster assessment, and wildlife protection and other aspects.

Especially since the 1980s, GIS software gradually commercialized , with the successive appearence of ARC / INFO, SYSTEM-9, INTER GRAPH, GENAMAP large GIS software and the SPAM, ILWIS, MAPINFO, ATLASetc which is called small medium-sized software and widely used in land evaluation, soil erosion control, water resources survey and management, socio-economic planning, disaster assessment, and wildlife protection and other aspects. Currently, the foreign main software includes MapInfo, AreInfo, ArcView and so on.

China's "Ninth Five-Year Plan" period had listed GIS as "top priority" projects, and focus on supporting the development of the GIS industry in China, China has established 27 provincial Environmental Information Center. GIS applied to urban water supply, city gas, city planning, urban underground pipelines, urban environment, urban roads, urban land etc. A new generation of GIS software technology-Com GIS (Components GIS, Component GIS) and Web GIS (World Wide Web GIS, the World Wide Web GIS) has been rapidly risen. At present, the domestic software contains;GeoStar, MapGIS.

III. THE COMPOSITION OF THE GIS SYSTEM

The GIS system is a computer system consisting of software, hardware, and to describe the geographic information (such as streets, boundaries, and the gas pipeline) and subsidiary information data. The system hardware consists of a network of workstations (such as by the two servers, digital workstation PC and digitizer) and printer, plotter external equipment. System software includes operating systems, GIS software, and database software. The software commonly used: GIS software from China MapInfo, AreInfo, ArcView, homemade GeoStar, MapGIS; Foxpro, Access, Orcal database software. The system database consists of three parts: a panoramic view of the database, the base map database and pipeline database.

IV. THE NECESSITY AND SIGNIFICANCE OF BUILDING A GIS SYSTEM

GIS system is a modern computer system using graphics and database technology to input, store, edit, query, analyze, display and output of geographic graphic and attribute data. The gas industry is mainly responsible for the natural gas transmission and distribution, and sales. Long-term management of the gas pipeline network facilities are the traditional practices - Document Management handmade operation, drawbacks obvious: drawing information is not complete, based on the lack of distribution dispatching, equipment management difficulties, difficult to optimize the design of the pipe network. Gas pipeline network GIS system can overcome these difficulties, the gas pipeline network facilities for electronic data management and information technology, decision-making for the gas transmission and distribution scheduling, file management, pipe network planning, pipe network repair, day-to-day operation and management, modern means of disposing of construction management and decision support.

V. THE OVERALL OBJECTIVE OF THE GIS SYSTEM

Establish a practical, advanced GIS application can greatly improve the level and efficiency of business management. Create a state-of-the-art scientific and efficient mode of business.

- Electronic Document Management. Achieve the whole process of electronic operations and pipeline facilities and Document Management. Make drawing query attribute queries and other work related business statistics graphically, electronic drawing easy updates in a timely manner;
- Emergency repair command. Receiving the report (Amendment), positioning breathe decision-making, the impact range of statistics and user communications integration processing. Improve the repair response efficiency and repair decisions correct rate, the accident loss and minimize the impact to the user;
- Decision support. Conduct analysis of gas transmission and distribution scheduling, the regulator monitoring, to provide reference information for the natural gas conversion work. Under the premise of the auxiliary data (such as population, residential areas, planning, etc.), planning predictive analytics;
- The scientific facilities management. Based on the use of facilities, maintenance and repair of facilities and scientific management, reasonable maintenance update measures proposed;
- A full range of information management. Gradually replace manual drawing business inquiries, statistical reports produced graphics rendering work to achieve the integration of information management. Convenient Web applications, and greatly expand the system application surface coverage.

VI. THE GIS MAIN FUNCTION AND ROLE

- Graphics and attribute data retrieval and query about the exact location of the pipeline, the depth, to the landfill situation, diameter, material;
- The statistical data of various types of pipelines and various types of attribute data, buffer analysis, and three-dimensional analysis;
- To provide reliable data for planning and design departments, so as to avoid the occurrence of major accidents in the building construction;
- Monitoring equipment for real-time monitoring of gas supply equipment (including nodes, valves, gas stations), and two-dimensional and three-dimensional graphics display running equipment running state;
- According to the analysis of the alarm signal to determine the point of failure, and provide the best troubleshooting program;
- Emergency treatment of sudden accidents: telephone repair, and quickly determine the request location and accidents, with 119 fire command center computer networking, the close relationship of the gas supply system and fire system, enhanced security measures, improve material accident and emergency response capabilities for emergencies;
- Various scales required for making user-road network, wiring diagrams, the vertical and horizontal cross-sectional view of the various types of data reports, output print.

VII. INTEGRATED USE OF GIS IN THE GAS INDUSTRY

- Information Management: manage gas industry pipe network information, device information, user information, economic information and environmental information;
- Decision support. Including: gas pipe network analysis and diagnosis of Present Situation, dynamic monitoring and optimization of scheduling, the project site, the choice of energy programs, programs of economic analysis;
- Simulation and emulation. It includes hydraulic calculation, program simulation and safety assessment.

VIII. CONCLUSION

The gas pipe network system is a newer application of geographic information systems, in terms of the breadth and depth of data collection, in the establishment and development of the mathematical analysis model and in the expansion of the system functionality has great plasticity. Meanwhile, the gas industry should collaborate with municipal, transportation, electric power and other departments, to establish a comprehensive data management system for the entire underground pipe network, to promote the city's information process.

REFERENCES

[1] Zhang Zhengdong, Principle and Engineering Application of GIS. Wuhan University Press, 2005.

[2] Dai Huaping and Li Zhiming, Passive Automatic Meter Reading System and Its Key Technology Research. Automation and Instrument, 2004.

[3] Zhuang Jiaxian，Gas Remote Intelligent Automatic Meter Reading System Application, Shanghai Gas,2006.

[4] Li Yulong, He Kaitao，Foundation and Drawing Design of Arc View GIS，Electronic Industry Press,2002。

[5] Anonymous，Research and Markets: Geographic Information System (GIS) Market in Oil & Gas Sector 2008-2012，M2 Presswire，2009.