Public Service Management System of Urban Placenames for Sanya Case

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***Abstract*—The rapidly growing amount of social interaction makes geographical names an important and indispensable medium for people in social and economic exchanges. Especially in today's information age, the frequency of usage of name information has increased greatly. In this paper, a method for the construction of a cities' names database is proposed. This will include the processing of the outcome data from the names pilot survey, the consolidation into the database, the development of the cloud service and management system based on the geographical names and zoning database, and the construction of a relatively complete set of the public service system of geographical names based on a website and touch screen interface. The method has been applied in SanYa, China successfully, and very good results have been obtained. The platform can provide not only accurate and convenient services of geographical names, but also promote its economic development and social progress.**

***Keywords*—Public service system; geographical names; geographical names database; cloud service platform**

I. INTRODUCTION

Along with the growing quantity of social interaction, geographical names have become an important and indispensable medium in people's social and economic activities. The demand of accessing quickly and transferring names information has increased. The traditional management methods and philosophy of geographical names and their corresponding management efficiency have been unable to adapt to the current situation. The building of a sound system of digital geographical names, that enhances their management capability and provides a service information system for economic and social development, is a novel and urgent solution.

Since the end of 1998, Ministry of Civil Affairs (MCA) has launched a comprehensive CGNIS (China Geographic Names Information System) and achieved initial success. Many cities have conducted normative work about naming names and placing name signs and initially established a database of geographical names. But they still lack proper management and construction experience at managing names data and sharing information. The social application of the outcome of names conduction is not popular. Therefore, the establishment of a management information system of geographical names is imminent. Developing and using geographical names resources has increasingly shown its significance. Since 2005, MCA initiated and implemented strategic initiatives of public service of cities names database, then the construction of place name information technology has made great achievements .

At present, some cities in China have already constructed some related systems; Zengcheng Geographic Names Information System was constructed based on the Digital Zengcheng Geospatial Information Public Service Platform using B/S technology and service-oriented architecture (SOA) technology. Based on a unified security system and rights management, this system has been built through component technology to respond to the changing business needs of the system flexibly and quickly to meet the urgent needs of the various sectors of the use of geographical names information [1]. The fundamental geographic database of Shenyang includes: control results, images, DEM, DLG, three-dimensional model of the city, places, address and other basic data, cadastral, pipelines, transportation and other thematic data

[2-3]. Names management and the developing integrated information systems and service is the core of Tianjin Binhai New Area of geographical names information technology [4].

The construction project has been completed in the city of Sanya. Sanya City is located in the southernmost tip of Hainan Island, and it is the Chinese southernmost tropical seaside tourist city. Its land area is 1919.58 square kilometers and the sea area is 6,000 square kilometers. Its resident population is 53.6 million, including the Han, the Li, the Miao, the Hui and other more than 20 nationalities. As the pilot area, Sanya City started the second national census of names. After one and a half years, the work was finished in January 2013. The pilot census found out the basic changing situation of names of Sanya City for nearly 30 years and generated 5348 Names achievement charts. Therefore, through the success of the pilot census, a geographical names database and cloud service management system for Sanya City can be constructed. This systems involves names data updating, maintenance, sharing, synchronization and public service data releasing management. It includes more feature-rich, information gathering and presents more diverse subsystems. By studying the specific construction method of names of public service projects and constructing this project, the speed of construction and serve economic and social development and people's production and living can be accelerated. Moreover, this has become the consensus of all levels of government and all sectors of society, and also a strategic task in the new geographical names.

II. Geographical Names Big Database and Public Service Cloud Platform

The specific content of names of public service projects is as follows. The first step is to build a database of geographical names and store the existing data and information according to certain norms and standards. Then, based on this database the public cloud service platform can be built, ultimately through a names public service website and a names touchscreen public service system [5-6].

A. System Framework

Construction of the system is an information management and service platform with computer hardware and network communications platform as a basis, policies, regulations, norms, standards, organization and safety system as protection, central data as a hub, and GIS, XML and other technologies as support [7-9].

As an important part of urban geospatial infrastructure database, the geographical names database can use address points attribute ID of the geographical names database to connect with the public the underlying database, database legal basis, social and economic statistics library and it can also provide good scalability for shared application of names data. Specific contents are shown in Fig.1.

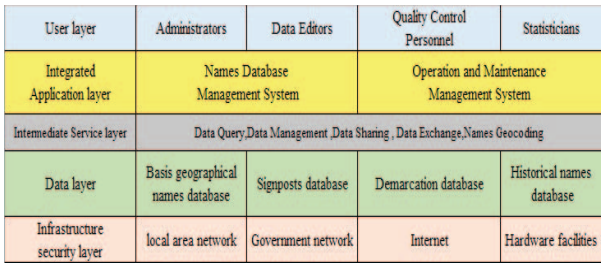

Fig. 1. Schematic diagram of system architecture

Infrastructure security layer, including network environment, software and hardware facilities, laws and regulations, various norms and standards and authorities of place names can ensure the smooth operation of the system. Data layer's core is geographical names database. It establishes corresponding database, and is combined with the underlying database city population, the legal basis for the database, social and economic infrastructure database, and geospatial foundation databases to support data source. It is deployed on server-side data server [10-11]. Intermediate service layer has a connecting role in the whole framework for data query services, data management services to achieve unified management in order to achieve a logical name information resource management and through data sharing services, data exchange, and other statistical analysis services to provide the necessary data resources for the upper integrated application system and provide a unified basic support services. Integrated application layer of names build applications on the basis of geographical names database. Application of these systems is directly faced with the user level. User layer refers to direct user application system. It can be divided into system administrators, data editors, quality control personnel and statisticians.

B. Geographical Names Database

The names database is designed and zoned according to the coding rules for names classification and category (GB/T 18521-2001), MZ basis of database data classification and data sheet structure of geographical names and address and coding rules for national names database address ([2010] No. 1 formulated by Civil Affairs Bureau), including: in the aspect of basic geographic information data (background), according to the actual situation of mapping results, we quote the results of MAPWORLD (National Geographic Information Public Service Platform) as the background data of basic geographic information of names and zoning database. The content of names and zoning thematic geographic data (space) and names and zoning thematic attribute information data (attribute) include administrative area name, the name of the non-administrative areas, residential, transportation, mass self-government organizations, water conservancy, electricity, memorial and scenic spots, units, buildings, sea, land water systems, land topography and 12 categories of place names and attributes and multimedia information. The data derived from the results of the second census of national names. Specific construction contents is shown in the following Fig.2.

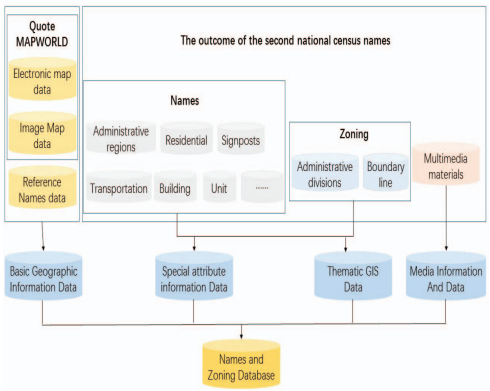

Fig. 2. Structure diagram of names and zoning database

As Fig.3 shown, the extraction, transformation, cleaning and other processing work to the data of the outcome of the names census pilot and storage the data which are in line with the requirements are done.

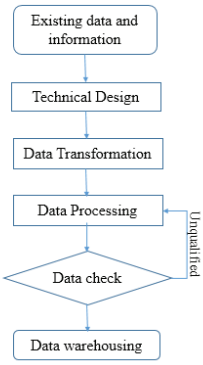

Fig. 3. Processing of names thematic geospatial data

In terms of technical design, on the base of full understanding of the need of data, we develop the relevant norms refer to the relevant national standards and industry standards and make these contents standardized, which include map symbols, hierarchical data, attribute data structure, feature classification and coding, data processing, quality control standards and other a series of content and to prepare for the follow-up work of processing data.

Data transformation is to solve the problem that the raw data are come from different sources, different data structures, different data coordinate system, to converts the raw data on the structure and transform geospatial vector or tile data based on the large scale into a unified data formats and coordinate systems which can be used in GIS.

Data processing includes organizing useful graphics and attributes of data and re-stratifying the data elements according to this standard. After the processing of related data, we should also process the map sheet edge to ensure the continuity of data. The completed topographic map data need to re-establish topology to build relationships between the individual elements.

To meet the display under the scale topographic map, symbolic data processing is also very important.

The entire construction process strictly implement quality control system and by checking results of data before storage we can ensure data integrity, accuracy and current trend.

Finally, when we storage the data, we will use Arccatalog by ARCSDE Data Engine to import the processed basic digital map data into a SQL server database to form an organic collection of databases.

C. Names Public Cloud Service System

Names and zoning database cloud service system is designed on the base of names and zoning data, including updating, and maintenance, query statistics and quality assessment, share synchronization of names data and managing and releasing public service data. Geographical names data updating and maintenance mainly depends on the daily work of the civil sector and the system interface is simple and friendly that allows users to use conveniently.

1) Integrated call subsystem of MAPWORLD

The system is constructed based on the permission of MAPWORLD, using API to call the geographic information service of MAPWORLD. It embed the service resources of MAPWORLD in construction and zoning applications of names and database as basic spatial data of place names thematic geospatial database background.

2) Subsystem of names information management

The system update and maintain non-administrative area name, residential, transportation, mass self-government organizations, water conservancy, electricity, memorial and scenic spots, units, buildings and other 11 categories of 43 small class name information (attribute and spatial position) update maintenance and online update and maintain historical name information (attribute and spatial location) and turn names now into historical names. Names updated by different users may exist with the same name, homonyms, or even duplicate problems. Data fusion can identify these problem data, through comparative analysis, to solve the case of duplication of data collection entry. Also the system has the function of name information query, the simple query and the combination of conditions query.

3) Subsystem of administrative division management

Administrative division data describe the realm of the basic administrative divisions elements and spatial and attribute information of regional and administrative bodies resident. Administrative division elements includes city, district (county), street (township) and community (neighborhood, village) and other regional boundary and attribute information. Administrative division code is consistent with existing national standards *(GB/T2260-2002 "People's Republic of China administrative divisions Code"* and *GB/T10114*-2003 *"administrative divisions below county codes Encoding Rules").* The system provides the function of administrative division information management, including zoning query, to update and maintain the administrative division, zoning statistics, zoning changes and other services.

4) Subsystem boundary outcomes management

Boundary data is used to describe the location and direction of administrative boundaries and provide basic data and scientific basis for the demarcation and border management. Boundary data including the boundary line, the boundary points, boundary markers, boundary released drawings and other boundaries and attribute information. Boundaries, boundary points, boundary markers numbering, naming, drawing should comply with national standards *("People's Republic of China administrative divisions Code" (GB/T2260-2002), "administrative divisions below county Encoding Rules" (GB/T10114-2003), "provincial boundary mapping specifications" (GB/T17796-1999))*. The system provides management function for the boundaries, boundary markers information, including storage boundaries, inquiry boundaries, inquiry pillar, boundaries and boundary markers updates and maintenance, statistical boundaries, boundary markers and demarcation statistical records management outcomes.

5) Subsystem of names statistics and analysis

Names statistical analysis statistics mainly according to regions (city districts, Towns) by categories, classes and small categories, by the same name, homonyms and namesake and by month, week and day cycle. Various specific statistics include The standard name, Roman alphabet spelling, belongs to (cross) administrative divisions, categories and geographical names updated.

6) Subsystem of names data quality analysis

The system provides quality checks, analysis and evaluation attribute information of names outcome data. It will also analyze and evaluate the quality of the results to generate a report. The report is to show by way of said sub-directory. Quality analysis and evaluation of the results of the report can be positioned directly on the quality of analysis and evaluation of data collection. This will facilitate the improvement of geographical names data online.

7) Subsystem of geographical names data quality control

Geographical names data quality control mainly includes quality control of spatial location and attribute names data and geographical names data network access.

8) Subsystem of data sharing and switching

The system provides the data export government geographic information on general coordinates (2000 Coordinate System) function to share to other government departments other than the Home and to realize data reporting and data cross-sectoral distribution and applications.

III. PRACTICAL APPLICATION

A. The Place Names Database Cloud Service Management System of Sanya

Names and zoning database management cloud service management system manages names spatial and attribute data, the specific features include:

1) Acquisition of geographical names data

Geographic Names, boundary management, division management, label management module include inputting, modifying, deleting, importing and exporting of place names attributes and spatial data. Inputting names data has achieved a rapid entry method, such as the flexible use of shortcuts, setting the default value of the data item, fast inputting of uncommon words, unit conversion tool, data required and checking the format of data items, etc. The system's home screen is shown as the following Fig.4.

Fig. 4. Cloud service management system

2) Quality evaluation of geographical names data.

Geographical names data quality analysis, Network access, data fusion module are specially developed for the level of development of regional imbalances, category difference data and differences between the data entry staff. It sets different data quality inspection program and show the quality of the data of different regions, different categories in list form. It can help us quickly grasp the current state of the quality of the whole database of geographical names data and each data's quality. It provides the collection authorities with the basis to improve data quality.

3) Query and statistics of geographical names data.

Geographical names data query, statistics module can be divided into two parts, query and statistics. The former can quickly and easily query to the appropriate names, and spatial orientation by location of administrative divisions, Category, time code, and other keywords. The latter statistic various place names, including the same name, homonyms, by division, by category and other statistics.

4) Mapping of names attribute and spatial data.

In the system construction process, due to the different sources of place names attribute and spatial data, there is a big difference in year, division, name, number in two sets of data. Mapping of names attribute and spatial data, it focused on solving the problems in matching names attribute and spatial data. By following strict "search place name resolution services (that is, automatically parse matching place names)," and "artificial association" and a variety of matching means can ensure quality and also improve the problems in matching names attribute and spatial data.

5) Sharing and exchanging names data

The system provides functions of importing and exporting offline names data to share and exchange data.

B. *Public Service of Names Inquiry System of Sanya City*

Sanya city names public service inquiry system include website (including mobile phone APP platform) and touching screen query system.

Public Service of Names inquiry system of Sanya City can be used as an intermediary to carry out public service of names information so that the public can be fast, convenient and timely to get accurate information on place names. The services can be served by the website mainly including into the city, the administrative division, address query, the query path, the surrounding query, bus routes and others.

The touching screen query system can be used as a window to release names information, convenience services and to display the image with the touch screen as a medium to carry out public service of names information. The standing names touch screen devices can be set at the station, marina, convention centers, roads, important business districts and other high traffic locations. Services in this system mainly include into the city, the administrative division, geographical names query, the query path and other names surrounding inquiry services. The inquiry system home is shown as the following Fig. 5.

Fig. 5. The interface of inquiry system of names public service

IV. Conclusions

With the advent of the information age, geographical names have become an important and indispensable medium for people in social and economic exchanges. In recent years, with the development of market economy and acceleration process of economic globalization, domestic and international economic and cultural exchanges become more frequent, the use of place names also become more frequent and it is increasingly expanding the scope of activities. Sanya' success shows that the complete set of the project's construction methods, including how the outcome data of the names pilot survey is processed and then saved into the big database, how to develop the cloud service and management system based on the geographical names and zoning database, how to build a relatively complete set of the public service system of geographical names based on website and touch screen of names-service, can not only accurate and convenient services of geographical names to the public, but also promote its economic development and social progress. It can also complete basic public service system and improve the level of government management. It is very important to speed up the construction of the public service project of geographical names. The establishment and improvement of the names of public service projects can meet the urgent need for geographical names information online service of government departments and also can speed up the process of city informationization and support government to do scientific and accurate decisions. Building a database and census of names and address is the foundation of digital city. It is also an important part of geospatial framework of digital city and a prerequisite for geographical names information sharing. In summary, the project's building is in the adaptation of globalization, information and modernization needs.

Acknowledgments

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