

RESEARCH AND IMPLEMENTATION OF GEOGRAPHIC INFORMATION SERVICE MODE IN DIGITAL HOME

Bing Lei^a, Ke Liu^{a*}, Yuhang Gan^a, Min Zhong^b

^a Satellite Surveying and Mapping Application Center, State Bureau of Surveying and Mapping, Beijing, China -
liuk@sasmac.cn

^b Hohai University, Nanjing, China -
15850506237@163.com

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ABSTRACT:

Accompanying infrastructure improvements and networking technology innovation, the development of digital home service industry has gotten more and more attention. However, the digital home service levels have not sufficiently met rising demand from users. Therefore, it is urgent to propose and develop new service modes for the digital home. Geographic information services can provide various spatial information services such as map search, spatial information query. It has become an inevitable trend to implement geographic information services in the digital home. This paper proposes three new geographic information services modes for the digital home after sufficient requirement analysis: pushed information service mode, interactive information service mode, personalized information service mode. The key technologies to implement geographic information services on digital televisions are studied, involving digital television middleware technology, network transmission technology and visualization technology. According to the service modes' characteristics mentioned above, a service system in the digital home is established to implement geographic information services on the basis of digital television. The implementation of geographic information services in the digital home not only enriches the digital home services content, but also promotes geographic information from specialization to public popularity.

1. INTRODUCTION

Accompanying infrastructure improvements and networking technology innovation, the development of digital home service industry has gotten more and more attention (Feng, 2007). In the United States, Britain and other countries have launched various home services which have met the daily needs of the digital home service to a certain extent, such as IPTV services, home security testing services, home care for the elderly, intelligent residential services (Zhang, 2012). In China, government agencies and relevant departments are engaging in promoting the development of digital home services. DNet-home of Hisense realizes the media resources integration, including digital television, VOD (Video-On-Demand) system, and local DVD recorders. Some companies in Hangzhou, China, provide users with services about digital TV channels broadcast, digital TV broadcast and self-service (Li, 2010). However, the digital home service levels have not sufficiently met rising demand from users (Liang, 2005). Therefore, it is urgent to propose and develop new service modes for the digital home.

According to authoritative statistics, location-relevant information accounts for 80% of the routine life information. It indicates that geographic information services play a significant role in the entire information services. It is essential for people's daily life (Liu, 2004).

Therefore, it is huge potential demand of users that geographic information services penetrate into the digital home and digital television. The implementation of geographic information

services in the digital home not only enriches the digital home services content, but also promotes geographic information from specialization to public popularity.

This paper proposes three new geographic information services modes for the digital home after sufficient requirement analysis: pushed information service mode, interactive information service mode, personalized information service mode. And then, an in-depth research of design and implementation of geographic information service mode for digital home has been done based on television terminals. We have constructed the geographic information service system for digital home, and make a detailed depiction to system design and key technologies.

2. GEOGRAPHIC INFORMATION SERVICES MODES FOR THE DIGITAL HOME

2.1 Pushed information service mode

Pushed Information service mode means that service information is pushed from servers to digital home clients directly. Many kinds of information services such as information query, browsing, labelling and analysis can be available based on digital maps, which provide basis for decision-making. The services are limited to the content provided. Therefore, this mode is unidirectional, non-interactive and passive for users.

* Corresponding author. Email: liuk@sasmac.cn

According to the requirement of digital home users, service information can be divided into three categories. (1) Social life service information: weather, social news, transportation, education, health care, tourism, shopping and other information. (2) Multi-scale digital maps information. (3) Basic information: administrative borderline, rivers, lakes, roads. Database is established to manage various types of service information. Information service is implemented via Internet connected on televisions. Pushed information service mode includes the following service functions.

2.1.1 Information Query: (1) Point information query: the digital home users can search for location and relative information about schools, hospitals, hotels, shops based on individual interests. (2) Rout Information inquiry: users can know how to from one place to another by information inquiring about roads and railways. (3) Neighbourhood query: users can get information about related facilities, surrounding environment and other information within the appointed regions, including information about transport infrastructure, culture, education, medical treatment, life service and so on.

2.1.2 Information Browsing: Information about location, route and surrounding environment can be illustrated by text, pictures and videos on multi-scale electronic map.

2.1.3 Information Analysis: Spatial analysis about optimal path analysis and happiness index calculation can be implemented to meet the needs of television users.

2.2 Interactive information service mode

Compared with pushed information service mode, interactive information service mode is more flexible. It supports requirements information, commodity trading information and other information to be uploaded and published using internet networking tools by digital home clients. It is bidirectional and real-time interactive for users.

The source of information is very plentiful, not only coming from the database on the servers, but also the uploaded information by users. Most information is about social life service information, such as traffic information, second-hand housing leasing information, commodity exchange information and so on. Users can upload and release the information mentioned above on internet.

2.2.1 Information Upload: (1) Demand information uploaded: digital Home users can edit and upload the demand information to seek central servers or other client information services. The main content covers education, health care, education, shopping, travel and other basic life service information, as well as rental trading, commodity trading. (2) Supply information upload: digital home users, as the information providers, can upload all kinds of service information for other users.

2.2.2 Information Interactive: The central servers scrutinize and manage the demand and supply information real-time uploaded from clients. Finally, the information is published on digital televisions to achieve information interaction.

2.2.3 Map Labelled: The location of the various types of service information from the digital home users is labelled on the electronic maps, allowing the users to select the most appropriate service.

2.3 Personalized information service mode

Personalized information service mode includes personal information management and personalized service to digital home users. It is the upgraded mode in comparison with interactive information service mode. The services depend on users' preferences and special needs, which could bring more comfortable and convenient user experience. It is an important mode to improve geographic information services to the digital home. Personalized information service model achieves a user-oriented information management and personalized service.

2.3.1 Information Management: Users can upload personal information, personal interests and hobbies, photos other personal information to television terminals. Personal information can be edit, stored and managed.

2.3.2 Customized Service: The demand and supply information is different because of the differences of ages, occupations, geographical environments. The digital home users can customize service according to their interests based on fundamental geographic information services, such as hospital distribution thematic maps for the elderly users, college distribution information for students.

3. ARCHITECTURE OF THE SYSTEM

According to the service characteristics of digital home, C/S structure was selected to establish geographic information service system (Yuan, 2008; Wang, 2007) (Figure 1). The system consists of the explorer, web servers and data servers. Geographic information services on digital televisions was implemented using network transmission technology and visualization technology based on system structure design, database structure design, function modules design and component-based development methods. The system finally completed flexible application of geographic information service system for digital home.

Users could send their requests to application server through digital televisions, such as place names, interactive information and various business services information.

The server executes appropriate actions in response to the request, and transfers the corresponding query results, as well as satellite imageries from geographic information services database to the client browser by HTML forms.

4. SYSTEM FUNCTION

When designing function of the system, we abided by following rules: rational system design, clear logic, independent models, high stability and scientific data processing. Function structure was shown in Figure2:

4.1 Data Maintenance

The data maintenance function was designed to manage and maintain image database, vector database, thematic database

and user management database of geographic information service system for digital home.

4.1.1 Data Import Module: Support to import a variety of external image data, vector map data, thematic data and their standardization.

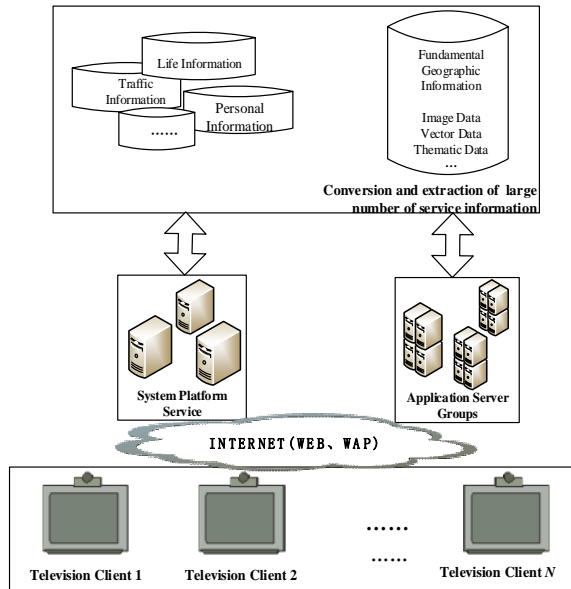


Figure 1 Architecture of the system

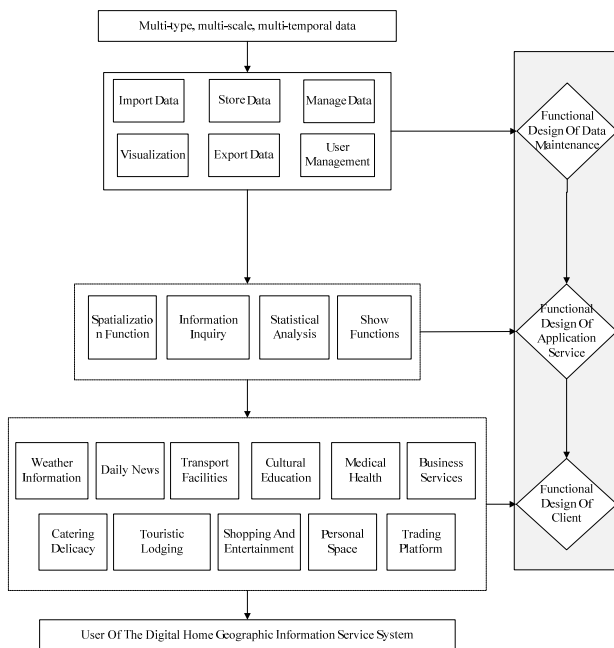


Figure 2 Function of the system

4.1.2 Data Storage Module: Multi-scale geospatial data and non-spatial data are stored, integrated and managed in a unified mode.

4.1.3 Database Management Module: Edit, splice, cut, back up, recover and manage logs for all types of data.

4.1.4 User Management Module: Set up different rights for system function and data using taking into account the systematic security and geographic information service requirement of different users.

4.2 Application Services

Through an integration of electronic map information services and digital home applications, information exchange between electronic maps and digital home provides users with location services, transportation services, travel services and life information services.

4.2.1 Fast Data Loading: Corresponding databases and data loading models were established to manage multi-source, multi-scale and multi-temporal data, including image data, vector data, terrain models, social life service data, multimedia data and text data, so as to achieve real-time and efficient data loading.

4.2.2 Information Query: Digital home users could do accurate or fuzzy query about service information by categories and keywords in accordance with personal interests and demands. Service information queries could be depicted as follows:

Basic Geographic Information Services: weather news, urban transport, leisure tourism, commercial network, cultural and education life and so on.

Interactive Information Services: job hunting information, recruitment information, commodity trading information, leasing house information, second-hand housing transactions.

Personal Information of Clients

4.2.3 Surrounding Environment Query: The system could provide related facilities and environment information within the region by online query, such as surrounding transportation facilities, culture, education, medical, life service and commercial outlets.

4.2.4 Visualization: The system could achieve multi-level remote sensing image display and roaming as well as exhibition of relative thematic information, text information and picture information according to the query conditions from digital home users. The results could be used as intermediate data and also be viewed directly.

4.2.5 Map Label: All kinds of information, such as address information of chain stores, hotels, schools, hospitals and other public service facilities and the user's personal address could be labelled on the map within appropriate scale. When users browse the map, they could focus on the concerned information at the same time. It is very convenient for users to choose the local and appropriate service sites.

4.2.6 Statistical Analysis: The service information could be summarized and analyzed according to the statistics of all types of social life information. The system could provide basic decision services about travel, shopping and entertainment for digital home users.

4.2.7 Map Operation: The system could offer multi-scale electronic map display and switch, zoom in, zoom out and cruise.

4.3 Client Services

Client services, which are supported by application services, could supply users with customized geographic information. The service contents include geographic living information, interactive information and personal information. It could also support surrounding environment browsing, map labelling and map showing.

In this system, the client service for digital home could be divided into three contents, including eleven service modules:

4.3.1 Public Information Service Module: The module contains nine sub-modules involving weather information, daily news, traffic facilities, culture, education, health care, business services, food and beverage, tourism lodging, shopping and entertainment (Figure 3). It could provide basic public information query, browsing and labelling and information statistics.



Figure 3 Tourism and lodging

4.3.2 Interactive Platform Modules: This module is used for displaying transaction information about building renting, sale and transfer. News source and contact information can be dynamically labelled on the map to supply users with convenient trading services.

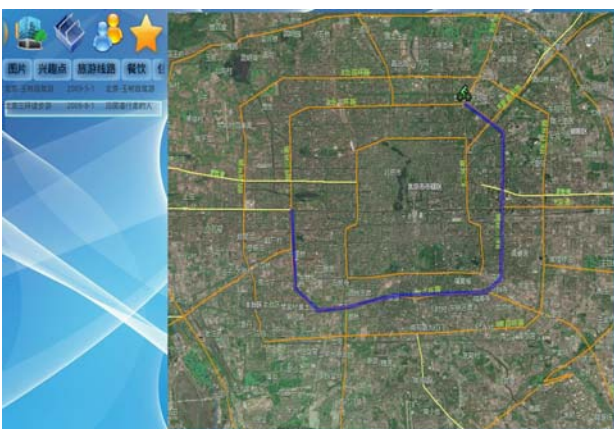


Figure 4 Personal space

4.3.3 Personal Space Module: It is used to store, manage and browse personal information, including interested points, personal pictures, tours, catering, accommodation, shopping and other personalized information (Figure 4). The information mentioned above can be illustrated on the map directly.

5. KEY TECHNOLOGIES

5.1 Digital Television Middleware Technology

Digital television middleware is the software between Digital television set-top box application system and system software. It has strong communication ability and excellent scalability. In actual operation, a set of standard application protocols and interfaces are defined in order to achieve fast supply of GIS data and rapid response of services. When digital television client application needs to access certain data or services, servers access the middleware system to find data source or related services from the internet. And then the middle system transports users' requests and reconstruct reply message. Finally, it transmits the results to the application programs.

5.2 Network Transmission Technology

Data transmission standards, information efficient coding and digital technology of television receivers are considered as the core of network transmission technology. High-speed networks access and interconnection network are the guarantee of digital television transmission network technology. Reliable connection of home broadband network is used to achieve propagation of digital bit stream from the head end to the terminal by compressing, sampling and quantization coding of geographic services information. Furthermore, information demodulation is executed on digital television terminals, and then social life service information can be displayed, real-time queried and interactively visited based on electronic maps in digital television terminals.

5.3 Visualization Techniques for Television Terminals

Visualization for television terminals is implemented through hardware and software equipment and relevant technologies on the basis of multi-source data standardization and visualization theory. Pre-generate image slices on the server according to a series of specific scales and block sizes to solve the problem of huge amount of data. And then achieve sustained and stable, efficient and reliable dynamic visualization services of geospatial information in virtue of block model transferred and level of detail model processing technology. At the same time, take advantage of pyramid structure to cache the tile image data, which significantly improves quality of client information visualization service.

Taking into account that the system has good scalability and operability, build the interface among client, server and database, based on the HTTP protocol, combined with the OGC specifications, SOA architecture and other standards to solve the compatibility problem between geographic information services system and television terminals. It implements dynamic display of spatial map and related thematic information on television terminals.

6. CONCLUSIONS

This paper describes new modes of geographic information services for developing the digital home. Moreover, geographic information service system is designed for digital television terminals. This system, combining electronic map information service and digital television application, implements geographic information services on the basis of digital television. The study builds up innovative modes of geographic information services and meets requirements for map, weather, news, and other relevant information. The implementation of geographic information services in the digital home not only enriches the digital home services content, but also promotes geographic information from specialization to public popularity.

7. ACKNOWLEDGEMENTS

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