

PERSONALIZED WEB MAP CUSTOMIZED SERVICE

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ABSTRACT

Personalized map service aims to satisfy users' personalized requirements for geographic information represented on maps; it realizes the personalization of map service resources, map service modes, and map service contents, so it can improve users' efficiency and experience. Personalized map service has two service modes: customization and adaptation. Fast and high quality map customization service is realized by parameterized template technology. Adaptive map service is realized based on user modeling by user behavior tracking and data mining which presents users with automatically and implicitly personalized map service. Parameterized template technology is a key technique used in current personalized map service. Based on parameterized template technology, that is easy for the storage in database and customization matching of personalized map service knowledge, users can expediently customize for personalized map service through choosing personalized templates or modifying parameters of templates and the system can also provide fast and timely personalized map service for users. In our research, we explore the use of parameterized template technology in personalized map service, build template library including interface template library, map symbol template library and color template library, and realize main functions of a personalized web tourist map service system.

KEYWORDS

Geospatial web services, Map design, Map content, Customization

1 INTRODUCTION

Since its birth the model of customization has been widely used in automobiles, home outfit, clothing, mobile phone and personal computers, this "tailor-made" personalized design concept also has been used on the publishing of paper maps and customization of web maps. Some map websites like Google map (<http://maps.google.com/>), MapABC (<http://www.mapabc.com/>), and 51ditu (www.51ditu.com), provide open API service, and realize customized service to professional users. But these customized functions are mainly for commercial enterprises and institutions, which provide the customizing data and function for users with development ability, not for ordinary users and melt the requirements of individual user into visualization design, such as map symbol, color, and interface.

Personalized map service is the new direction of map service and it requires advances in customization and adaptation. Personalized map customized service is the primary stage of personalized map service, which can meet user's requirements for personalized map to a certain extent through user interaction. Supported by parameterized template technology, customized map service firstly matches user customized information with map visualization template (such as interface template, symbol template and color template), and form basic map visualization system; then modifies and optimizes the system to make it in conformity with the cognitive characteristics and preferences of user through analyzing basic information of user, and finally pushes the optimized system to the user. Through submitting orders (network customization) or modifying template parameter (customized design by users), personalized web map customized service system provides personalized web map with customized visualization contents including interface, and map symbol and color.

In our research, we explore the use of parameterized template technology in personalized map service, build template library including interface template library, map symbol template library and color template library, and realize main functions of a personalized web tourist map service system. There are seven parts in this paper: (1) introduction; (2) concept and research contents of personalized map service; (3) customization by parameterized template technology; (4) framework system of personalized web map customized service; (5) building of template library for personalized web map customized service; (6) design and implementation of personalized web tourist map service system; and (7) conclusions.

2 CONCEPT AND RESEARCH CONTENTS OF PERSONALIZED MAP SERVICES

2.1 Concept of Personalized Map Service

Personalized map service aims to satisfy users' personalized requirements for geographic information represented on maps; it realizes the personalization of map service resources, map service modes, and map service contents [1-2], so it can improve users' efficiency and experience.

Personalized map service has two service modes: customization and adaptation. Fast and high quality map customization service is realized by parameterized template technology through the user configuration and modification template. Adaptive map service is realized based on user modeling by user behavior tracking and data mining which presents users with automatically and implicitly personalized map service.

Personalized map customization service studied in this paper can be divided into two kinds[3]: one kind is the real-time customization and real-time use mode, namely map service modules in the form of template controls are provided for users to customize, which includes the customization of interface, map visualization, navigation tool, basic function, assistant tools, and other customization requirements; another kind is online customization and offline processing mode, namely after obtaining user personalized map requirement online, according to which and sometimes user profile, cartographers design the personalized map fast and efficiently with the help of templates, and then send to the user.

2.2 Research Contents of Personalized Map Service

Research contents of personalized map service in general include the following theories, technologies and methods [3]:

- 1) Framework system: including the conceptual framework, the theoretical framework and the technical framework.
- 2) Organization and representation of spatial data: including classification, storage and representation of spatial data.
- 3) Interface design: including the design of interface layout, interface tools, color and style of interface, interface templates and their library, which need user cognition experiments.
- 4) Map visualization: including map visualization knowledge database (map design criterion and standard, expert experience, etc.), personalized symbols and symbol library, personalized cartographic generalization, user cognition experiments, etc.
- 5) Context modeling: including context awareness theory, classification and modeling of multi-dimensional context.
- 6) Customization and adaptation mechanism: including customization and adaptation mechanism of interface, map visualization and spatial data recommendation.
- 7) Evaluation: including evaluation framework, methods, criterion, the index system, the relation between evaluation and design.
- 8) Prototype system design and implementation: including the requirement analysis, the prototype system architecture, the system module design, and implementation technology.

3 CUSTOMIZATION BASED ON PARAMETERIZED TEMPLATE TECHNOLOGY

Parameterized template technology is a key technique used in current personalized map service [4]. Firstly, map service is divided into three subjects: interface, map visualization, and spatial data. Then elements in these subjects and their parameters are analyzed, and every element is represented with its parameters. The combination of different parameters' value forms different personalized element template (Tab.1, Tab2), and the set of these templates makes template library.

Tab.1 Subjects, elements and parameters in personalized map service

Subjects	Elements	Parameters (template type)
Interface	Interface layout	{[E]-shaped、[可]-shaped、[回]-shaped、[同]-shaped、[互]-shaped }
	Interface style	{spring 、 summer、 autumn、 winter}
	Interface font size	{big、 middle、 small}
	

Tab.2 Parameter value of interface font size template for the old and young

Interface font size template	Old	Young
Big	17pt	15pt
Middle	15pt	12pt
Small	12pt	10pt

The templates of interface, map visualization and spatial data, which are adaptive to users and other context, and acquired through user cognitive experiments [5], are the foundation of personalized map customization. Before self adaptive map service system with self modification function is implemented completely, finely granular template is efficient way to close in upon self adaptation [6]. Based on parameterized template technology, that is easy for the storage in database and customization matching of personalized map service knowledge, users can expediently customize for personalized map service through choosing personalized templates or modifying parameters of templates and the system can also provide fast and timely personalized map service for users.

4 FRAMEWORK SYSTEM OF PERSONALIZED WEB MAP CUSTOMIZED SERVICE

4.1 Theory Framework

Personalized web map customization service system is a complex system to satisfy users' personalized requirements for geographic information, which is the comprehensive application of computer science, cartography, ergonomics, cognitive psychology, and experimental psychology [3].

Because of its complex framework, rich contents and widely application, personalized web map customization service involves multitudinous disciplines and subjects as shown in Fig. 1.



Fig.1 Theory framework of personalized web map customization service

4.2 Technique Framework

The adaptation objects of personalized web map service is the dynamic context of geographic space (user, task, system, surroundings), the core is personalized decision-making engine (matching and automatic

decision-making based on the context knowledge, rules, and templates), the adaptation basis is personalized web map service knowledge database [6] (including the templates of personalized interface design, map design, and spatial data, and the knowledge database of personalized interface design, map design, and features constraint), the adaptation subjects are interaction and service window (personalized interface and map). So the basic frame of personalized web map service system (Fig.2) includes four parts [3]: the real context, personalized decision-making engine, personalized web map service knowledge database, and interaction and service window.



Fig.2 Basic frame of personalized web map service

5 BUILDING OF TEMPLATE LIBRARY FOR PERSONALIZED WEB MAP CUSTOMIZED SERVICE

5.1 Acquisition of Template Design Schemes

Traditional map design templates mainly come from typical maps or map system design cases, such as interface templates, color templates, and symbol templates [4]. Personalized web map customized service pay much attention to the personalization, and experiment method [5] is an effective way to obtain personalized template design schemes. Therefore, the authors design and implement a series of experiments, including rules acquisition experiment of cartographic visualization adapting to devices, rules acquisition experiment of cartographic visualization adapting to user visual perception and cognition, user interest acquisition experiment based on browse behavior [7], and rules acquisition experiment based on customization behavior. Based on these experiments and experimental data mining, much more personalized template design schemes can be obtained, and then design and realize various personalized templates, and offered to users by the personalized web map customized service system.

5.2 Storage of Template Knowledge

Personalized web map customized service templates are stored in several libraries, including interface library, symbol library, color library, label library, and cartographic generalization library. Each library contains several templates. Take interface template library (Tab.3 and Tab.4) for example, it stores the basic information of interface, including the layout, style, font, and the position and style of elements on interface.

Tab.3 Interface design template library knowledge table

Name	Type	Illuminate
ID (ID)	int	Interface template ID
Interface Layout (UILayout)	Char(30)	Type of interface layout
Interface Style (UIStyle)	Char(30)	Type of interface style
Interface font size (FontSize)	int	Value of interface font size
Interface element1 (Element1)	Char(30)	Interface element1's name
.....
Interface elementn (Elementn)	Char(30)	Interface elementn's name

Tab.4 Interface elements design template library knowledge table

Name	Type	Illuminate
ID (ID)	int	Interface element template ID
Interface element name (Elements)	Char(30)	Interface element name
Interface element position (ElePosition)	int	Interface element position
Interface element style (EleStyle)	Char(30)	Interface element style

6 DESIGN AND IMPLEMENTATION OF PERSONALIZED WEB TOURIST MAP SERVICE SYSTEM

6.1 Template Design

Considering the influence of tourist web map users, network and system condition, and real use surroundings on tourist web map service system, the templates in personalized tourist web map service system are divided into the templates of user interface, map visualization, navigation, basic function, and assistant tools. Take navigation template for example, the navigation templates include self-driving tour template, traveling in a group template, and pedestrianism (or by bicycle) template, which is shown in table 5.

Tab.5 Navigation template

Template	Contents
self-driving tour	Sights, motel, typical self-driving route, weather, travel device
traveling in a group	Sights, hotel, typical travel route, travel agency, ticket agency, team shopping, weather
pedestrianism (or by bicycle)	Sights, camping, typical pedestrianism route, weather, travel device

6.2 Implementation of Real-time Customization and Real-time Use Function

The framework of personalized real-time customization and real-time use function is shown as Fig. 3. Based on the tourist web map service templates, map service modules in template widgets are provided for users to customize, the contents include [3]: (1) interface customization: layout, style, and font; (2) map visualization customization: content, color, and symbol;(3) navigation customization: items and style; (4) basic function customization: map basic operation tools, search tools, and results display window; (5) assistant tools customization: overview, scale show table and adjust tool, pan tool group, area switch tool, and layer control tool; (6) other customization requirement: other personalized requirement submitted to the system.

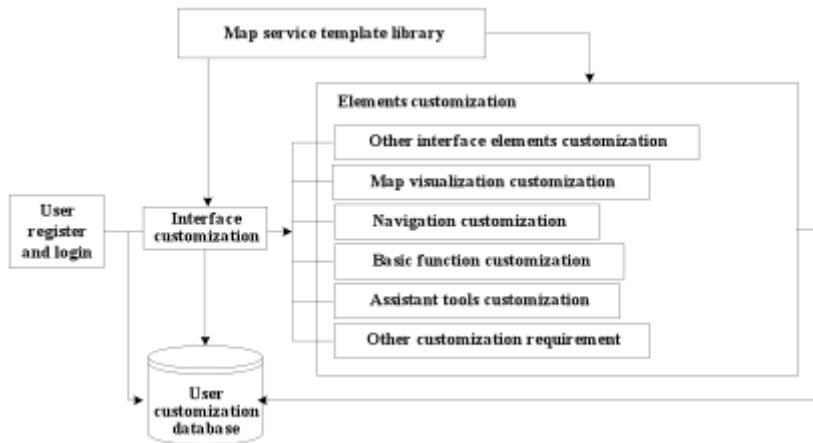


Fig.3 Framework of real-time customization and real-time use mode

6.3 Implementation of Online Customization and Offline Processing Function

Online customization and offline processing mode is primary personalized map service way, but this mode can obtain more detailed user requirement information, so cartographers have more design space and time, and have opportunity to intercommunicate with user until satisfying user's personalized demands. This service mode is to obtain user personalized map requirements, according to which and sometimes user profile, cartographers design the map fast and efficiently with the help of templates or modulated templates, and then send to the user. Fig.4 is the basic flow of online customization and offline processing mode.

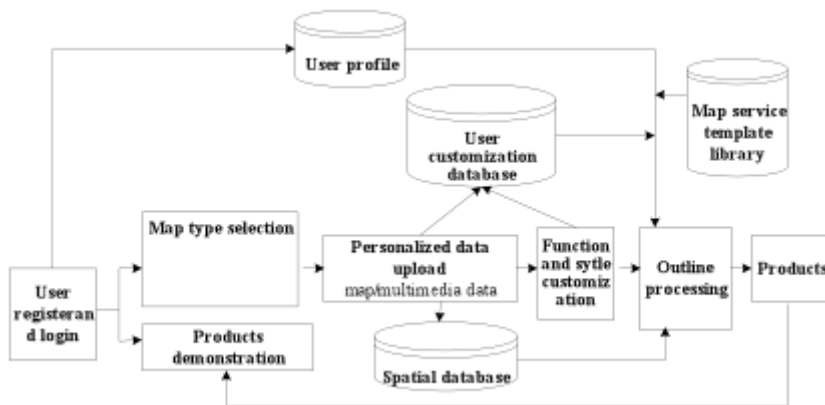


Fig.4 Basic flow of online customization and offline processing mode

The system lists out the contents for customization, and designs and depicts the detailed types and requirement tips, making it convenient for users to choose from or to submit requirement purposefully. The main methods are, when the user's mouse moves to the triangle icon after an optional type name, the demonstration of this type will be shown to user; obtaining detailed user's requirement description information through text entry; obtaining user's personalized map data through data upload tool; obtaining user requirement of data format through user selection from several formats listed out.

7 CONCLUSIONS

Thanks to the development of new spatial information technology, map service has changed in many aspects, such as popularization of users, real time updating of geospatial database, diversification of interactive device, and personalized idea of service. So, personalized map service comes forth to be a challenged project in cartography and geographic information systems.

In our research, we explore the use of parameterized template technology in personalized map service, build template library including interface template library, map symbol template library and color template library, and realize main functions of a personalized web tourist map service system.

The personalized map customization service function of this system can obtain detailed user personalized requirement, the modules are usable as soon as they are customized, or the templates are demonstrated dynamically by pictures, these improve user experience and customization efficiency.

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