

BUILDING THE CADASTRAL INFORMATION LOOKUP SYSTEM BASED ON OPEN SOURCE WEBGIS TECHNOLOGY FOR COMMUNE OFFICERS IN LONG XUYEN CITY, AN GIANG PROVINCE

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ABSTRACT

Sharing, querying and displaying cadastral information via the internet is necessary for improving the quality of land management in Long Xuyen, a young city with high rate of urbanization. In this study, the lookup system of cadastral information is built on the open source WebGIS with three-tiers architecture. The cadastral data are imported and stored in PostGIS which is support for geographic objects to the PostgreSQL object-relational database. The server-tier includes Apache HTTP server and GeoServer mapserver. OpenLayer and GeoExt are used for client application. The cadastral map including spatial and non-spatial data is published through the internet based on Open Geospatial Consortium (OGC) standards including: Web Map Service (WMS) and Web Feature Service (WFS). The cadastral officers in commune divisions can use the web browsers, namely Internet Explorer, Mozilla Firefox, etc. to access the cadastral data stored and managed in data-tier and server-tier.

Keywords: open source WebGIS; cadastral information; Long Xuyen city;

1. INTRODUCTION

Long Xuyen city is the capital of An Giang province. It is also a political, economic, and cultural centre of this province. It is located in the Mekong Delta, in the south-western part of Vietnam. With high rate of development and urbanization, Long Xuyen city is one of the most populous and prosperous cities in Mekong Delta. Therefore, cadastral information of this city changes day-by-day by the transactions of people associated with land and housing. This is the pressure on staffs who are working in local land management, especially at the commune divisions in change detection of parcels in order to satisfy the timely and effective management.

The realities show that cadastral officers in communes, wards or townships have to face with two major problems related to legal and technical. These problems are the synchronization and reliability of data from district-level divisions to commune-level divisions. According to regulations of the Ministry of Natural Resources and Environment in Vietnam (MONRE), changes of cadastral data must be regularly updated and exchanged between district divisions and commune divisions. Vietnam Land Information System (ViLIS) software was deployed in all levels. Unfortunately, it proved ineffective on the ground that it required a huge amount of time and effort to set up and transfer the software and to train the staffs.

In recent years, with the progressive development on Information Technology and Communication (ITC), sharing and accessing geospatial data via the internet has become popular. Google's mapping services are a good example for this development. Accompanying with that development, the applications of geographic information system over the web environment (WebGIS) also has started to develop. These may include Ho Chi Minh city geographic portal, GIS Hue, Vietbando, etc. Therefore, the study to build the cadastral information lookup system for officers in commune divisions based on open source WebGIS technology has proposed. This study will basically solve the two problems that have been analysed. In addition, it also meets the requirement for updating regularly of change in land using at commune levels.

2. SYSTEM ARCHITECTURE

The cadastral lookup system has been built based on WebGIS three-tier architecture that is illustrated in figure 1.

2.1. Server-tier

The servers include HTTP Server (Web Server) that has functions to provide normal Web services over Hypertext Transfer Protocol (HTTP) and Map Server that provides services relating to spatial data. Map Server operates based on Web Server. In this model, Apache Tomcat version 7.0 has been chosen for operating as HTTP Server and GeoServer version 2.1.4 for operating as Map Server. Both of them are open source, free and working on the Java platform.

2.2. Database

Original cadastral data are the digital cadastral map in Microstation format (.dgn) of thirteen wards or commune divisions. Firstly, the coordinated system of original cadastral data will be transform from VN-2000 (Vietnam national coordinate system for cadastral data) to WGS-84. After that, they will be converted to ESRI shapefile format (.shp). Finally, from the shapefile format, they will be imported to Database management system (DBMS) PostGIS/PostgreSQL as the tables. Each table stores information of each ward or commune that include some attribute fields are shown in Table 1.

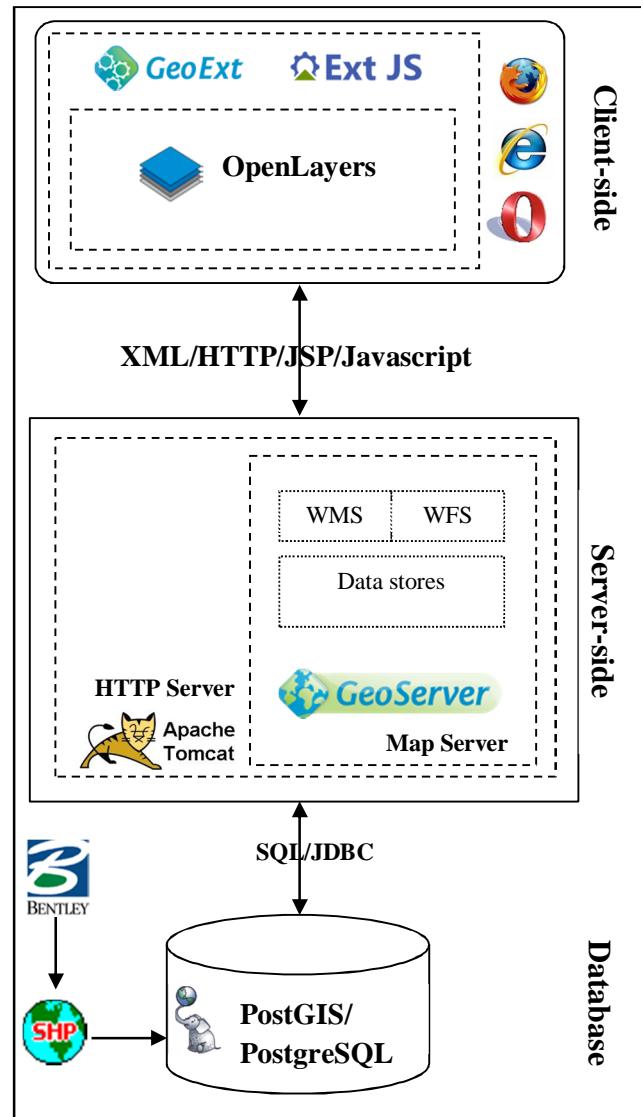


Figure 1. System Architecture.

Data stored in DBMS PostGIS/PostgreSQL are connected and interacted with GeoServer in Server-tier by using database connection parameters (Java database connectivity – JDBC) and Structured Query Language (SQL). To represent thematic maps in the client-tier, the data have been standardized using Style Layer Descriptor (SLD) that is implemented by Open Geospatial Consortium (OGC). In this case, the field namely KyHieuMuDichSuDung, meaning land use id, has been chosen for classification by using Unique Values based on SLD.

Table 1. Column names of tables

Fields	Data type	Description
Gid	Serial	Geometry IDs, primary key
ThoiDiemBatDau	Date	The date when land use right was granted
ThoiDiemKetThuc	Date	The date when land use right was revoke
MaXa	Character	The ward or commune IDs
MaDoiTuong	Character	Feature IDs
SoHieuToBanDo	Numeric	Pieces of cadastral map IDs
SoThuTuThua	Numeric	Parcel IDs
SoHieuToBanDoCu	Numeric	Old pieces of cadastral map IDs
SoThuTuThuaCu	Numeric	Old-parcel IDs
DienTich	Numeric	Area (square meter unit)
DienTichPhapLy	Numeric	Legal area (square meter unit)
KyHieuMucDichSuDung	Character	Land use ID
TenChu	Character	Parcel owner names
DiaChi	Character	Address of parcel
DaCapGCN	Boolean	The registration status of parcel
SHAPE	MultiPolygon	Geometry column

2.3. Client-tier

The graphic user interface (GUI) of the lookup system has been built on JavaServer Pages (JSP) Web programming and Javascript open-source library for web mapping applications, including OpenLayers, GeoExt and ExtJS. The client users can use web browsers such as Internet Explorer, Opera, Google Chrome or Mozilla Firefox, etc. to access the lookup system for querying and viewing cadastral information that was implemented in

cadastral maps and their attributes. In addition, the users can exploit the lookup system easily and quickly without installing third-party software. It also does not take much time to get familiar with the user interface without attending training courses.

3. RESULTS AND DISCUSSION

3.1. Main interface of the lookup system

This research is conducted in two phases. In the first phase, main users are the officers working in land management at ward or commune divisions. Therefore, the main page (index page) of the lookup system is login page. Only users who are granted usernames, and passwords can access and use the lookup system. The interface of the login page is shown on figure 2. After completed and supplemented with other functions, the lookup system will be open to serve the community.



Figure 2. The interface of login page.

When successfully logging in, the users will be redirected to the home page of the lookup system. By the initial default, the lookup system will automatically load a base layer that is a satellite image of Google Map services (Google Hybrid) to the map. To load the specific cadastral layers, the users can click on icon in the left panel. Then, the new window will show all cadastral layer maps of wards and communes in Long Xuyen city. This window is illustrated in figure 3. To enlarge any cadastral map layer, the users choose the name of that layer tab and click on the button (Add) in the right bottom of the window. Once the task is completed, the users can click on the button (Close) to close the window. In case the users want to hide or show any of the layers in the left panel, they just turn off or on the check icons in layers list respectively. The color legends of cadastral map layer in the right panel which are stipulated by the MONRE indicate land use purposes.

Tên lớp	Tiêu đề	Mô tả
sde:BinhDuc	Phường Bình Đức	Thông tin địa chính phường Bình Đức
sde:BinhKhanh	Phường Bình Khánh	Thông tin địa chính phường Bình Khánh
sde:DongXuyen	Phường Đông Xuyên	Thông tin địa chính phường Đông Xuyên
sde:LongXuyen	Long Xuyên	Thông tin hành chính thành phố Long Xuyên
sde:MyBinh	Phường Mỹ Bình	Thông tin địa chính phường Mỹ Bình
sde:MyHoa	Phường Mỹ Hòa	Thông tin địa chính phường Mỹ Hòa
sde:MyLong	Phường Mỹ Long	Thông tin địa chính phường Mỹ Long
sde:MyPhuoc	Phường Mỹ Phước	Thông tin địa chính phường Mỹ Phước

Figure 3. The add-map-layer window

3.2. Main functions of the lookup system

The lookup system can provide some basic functions that the same as many other Desktop GIS software such as: zoom extent, pan, zoom in, zoom out, view history, view next, measure length, measure area.

By clicking on the parcel, the information of that parcel will be shown in popup window.

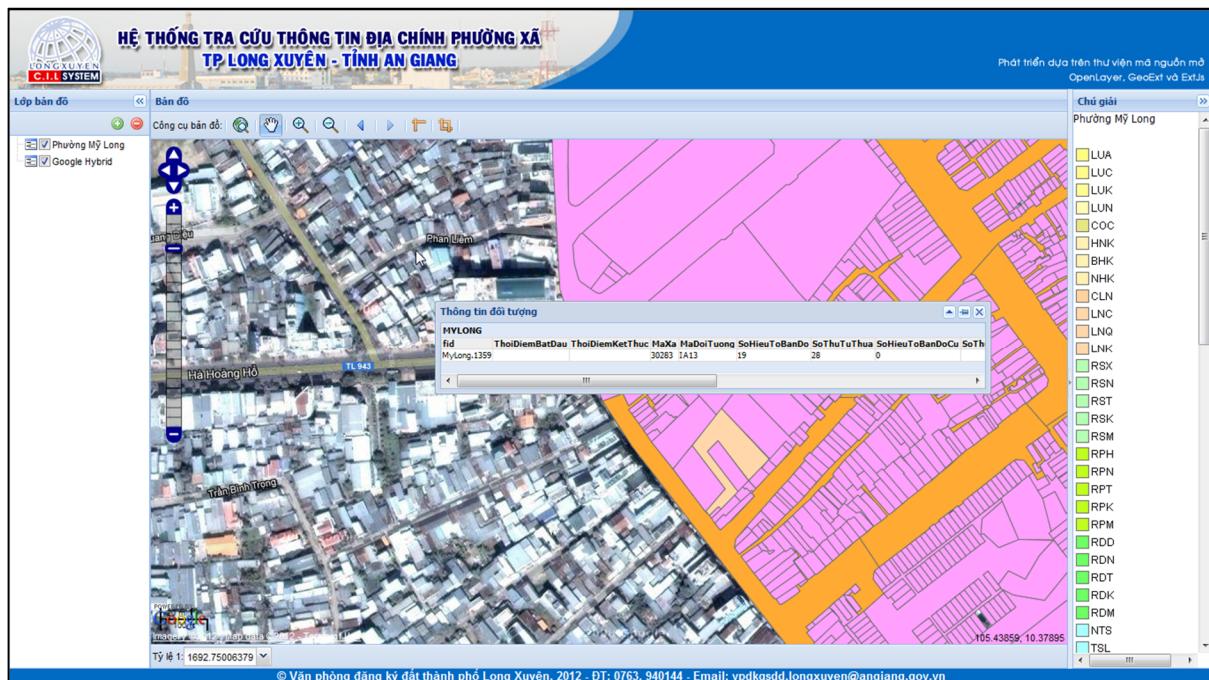


Figure 4. The main user interface of the lookup system.

4. CONCLUSION

Although the system is still in the experiment process, it comprehensively meets the urgent demands of grass-roots officers in looking up the cadastral data. It can timely and promptly provide the updated information of the land with the relatively reliable level. This system can serve as the basis for the cadastral officers to check the land status, which helps reduce the cost and time consumption in identifying the actual land conditions on-site at wards and information stored at other higher cadastral offices. The information of constant

changes in land use at wards, communes and other higher levels will be monthly updated, which ensures the timely accuracy of the land database. This system, therefore, can accelerate the process of land identification in the timely and effective way.

At the time being, there exists the inconsistency of the current cadastral data. The process of update and synchronization also encounters technical errors. Therefore, certain information in the database negatively affects the reliability of the system. In the next phase of this research, the system will be upgraded and modified with functions of attribute query, edition, and spatial and non-spatial data update through internet. At the same time, the data will be checked and standardized in order to ensure the stable operations and efficiency of the system.

5. REFERENCES

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