DESIGNING BASIC FEATURES IN GIS USING OPEN SOURCE LIBRARY

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ABSTRACT

With the C# programming language combined with two open source library SharpMap and DotSpatial, a GIS software used Vietnamese language was built. This software satisfied the basic needs of GIS, and universalized GIS to many users, ease of use throughout the Vietnamese user's guide.

1 INTRODUCTION

Nowadays, the tendency of using technology based on open source is growing rapidly, especially in periods of economic crisis and safely secure data information is spreading across the globe. The open source GIS (Geographic Information System) software has been developed drastically, the function becomes stronger and more efficient, the interface has been designed more friendly and more flexible, suitable for many different purposes. The gap in functionality and efficiency among the commercial GIS softwares and open source GIS softwares are being shortened.

The organizations, professional associations used the applications, open source softwares such OGC (Open Geospatial Consortium) has always tried to offer spatial data standards, libraries for software development to promote the expanse of open source community. Reality has demonstrated this through a serial GIS products, applications in many fields and still being developed both inside and outside our country.

Due to the commercial software's high investment costs, and because of technological mastery oriented, proactive in their own safety and security, the using of open source software is not only popular in developing countries, but also in developed countries such as Germany, Spain, Netherlands,....

The cost for license and maintainance can be a major obstacle (such as when the software need to be upgraded, they have to implement the system on a large scale) to ensure the sustainability of the system. In addition, the using of open source in order to improve the flexibility and the ability to create customized on-demand system is an undeniable advantage.

Representatives for this development are the Food and Agriculture Organization of the United Nations Industrial (FAO). FAO has carried out a project called OSCAR (Open Source Cadastral And Registry tool) with the goal of applying open source softwares (PostgreSQL, PostGIS, uDig) to build a model of land information system that can be applied to many countries with different institutions.

The results of the project have built an ideal data model OCDM (OSCAR Conceptual Data Model) based on LADM model and designed a framework of database management system based on OSG. There are many users are currently using commercial GIS softwares as well as the open source code to support different purposes, from basic to use database to calculate the application, or self-develop other specific additional functions, applications to serve a particular need GIS. The major problem is the cost to purchase commercial software and languages limitation, because most softwares are used in English, and this has limited the GIS generalization for all user in our country.

Problems encountered when using the foreign software is the language displayed, the user must have the ability to read, understand the ordinary and special GIS English to understand the interface, the description or English display on the software's interface and help. There are numbers of open source softwares have the permission to transform the interface language into Vietnamese, but the language used in the help is still used in English.

Therefore, a complete Vietnamese GIS desktop application which overcome the cost and language issues will be the foundation to promote GIS technology to every user in our country and is a worthy demand.

2 METHODOLOGY

The tools to implement the software development consists three main components: (i) programming language based on .NET Framework; (ii) the open source libraries; (iii) database management systems.

2.1 Programming Languages:

Programming language C# (.NET), was designed by Anders Hejlsberg. This is an object-oriented, modern, simple, easy to learn, powerful, flexible, little key words language, which consolidated from preeminent properties of Java, C++ and other languages . C# is one of many programming languages supported by .NET Framework, such as C++, Java, VB....

We can understand .NET Framework is a translation center, in which all languages are supported by .NET Framework will be converted into MSIL (a form of intermediate code) and since then new compiled immediately (Just in time compiler - JIT Compiler) into executable files such as exe. In .NET Framework structure, there is also has CLR (.NET Common Language Runtime), a functional block provides all the services that the program needs to communicate with the hardware, the operating system. .NET-based applications actually compile and run the machine level, have capable of direct memory access to the same familiar applications written in C or VB.

2.2 The GIS open source library:

- The GIS open source library DotSpatial: DotSpatial is managed by Daniel P. Ames of Ihado State University. This is a free GIS library, open source, consistent, and independent, and is the combination of many GIS libraries based on .NET with purpose is to provide a set of programming tools for .NET working with spatial data (including component mapping, projection library, data library, interface plugin...). It allows the programmers to easily incorporate spatial data analysis and mapping to create applications of GIS or contribute GIS applications to the community. DotSpatial is builded on the .NET Framework 4 basis, which includes a large library and provide language interoperability (each language can use code written in other languages) between types of different programming languages. Programs written under .NET Framework run in CLR environment, a virtual appliance providing services such as security, memory processing and handling exceptions.

- The GIS open source library SharpMap: This is a software which source code is free to use and developed by programming community based on C# and .NET; SharpMap is

allowed to connect many spatial databases such as Shapefile, PostgreSQL/PostGIS, Oracle, OLEDB, SQL Server, SpatiaLite and many other GIS data types in the form of GDAL/OGR for building desktop and internet applications vividly. SharpMap's advantage compared to other libraries is that allow programmers to intervene into the library to edit the code to customize and develop the system. In addition, this library supports multiple spatial query function among the map data, and between map data and attribute data tables in the SQL Server database to create online specialized maps.

2.3 PostgreSQL database management systems have the extension to manage the spatial data called PostGIS, used to storage and display map information GIS.

PostgreSQL (aka **Postgres**) is a database management system object-relational, was developed in the computers research department Berkeley, University of California. It is an open source program, support a very large part of the SQL standard and offers many modern features such as complex queries; foreign key; Trigger; frame view; the integrity of the transaction; check access multiple versions simultaneously.

Postgres also support strongly in the spatial data storage. Postgres combines with PostGIS module that allows users to store spatial data layers. When using Postgres, PostGIS combines with other GIS softwares will support the display, query, statistics or spatial data processing. In Postgres, the tables are inherited together, the functions and operators are polymorphic, and the users can define new data types, new functions, new operators suitable for the demand. The Postgres standard syntax compliance with the standards of SQL92 and many features of SQL99. Postgres provides many data types. Besides the normal numberic and string data types, it also provides geometry, boolean data type and storage spatial objects. PostGIS - the open source software for analysis, query spatial database connect to Postgres databases, supporting search queries geographic location in database query language. Also, PostGIS supports a number of rarely features in spatial database softwares. In fact, PostGIS "allowed" Postgres server is used as a spatial database auxiliary for GIS data.

3 RESULTS

The software was named IRGOG, and aimed to universalize GIS to to many users in the community, so it should have the functionality in moderation requirement and have the high-level function by adding the additional modules.

3.1 Characteristics of GIS open source software IRGOG

The open source software in this study was designed with the basic functions of GIS, "run" independent, so that it can universalize GIS to many users in the community and has some characteristics as follows: User-friendly interface in Vietnamese; Satisfying the basic needs of GIS so that it can universalize GIS to many users; Totally free; Easy to access; Easy to use via the software's Vietnamese user manual; Can be intergrated plug-in to satisfy the more advanced and intensive GIS using in many fields; The software can be updated frequently and can be applied the modern technology.

3.2 Software function designing

The software has been designed as a fully extended**.** The main application only has the framework**,** all remaining functions are written as Extension**.** The entire program consists of the following projects**:**

GIRS: Project contains the main program host; **DotAPI**: Library project contains the interface used for other projects; **BaseFunctionProj**: Setting project for layout (including menu, toolstrip, status bar), the functions in the general functional group (create project, open

project, save and exit application); **MapFunctionProj**: Setting project for the map basic functions (add layers, delete layers, move view, zoom in, zoom out, zoom foward-backward, identify, open attribute table, query the data, attribute assigning, join table, switch selection); **EditFeatureProj**: Setting project for functions in editing group (move, node editing, merge objects...); **GeoToolProj**: Setting project for overlay, clip, combine, create buffer functions...; **MapPrinterProj**: Setting project for printing function group (creating print, frame map, map scale, add grid, page set up).

3.3 PostGIS database connection tool's structure

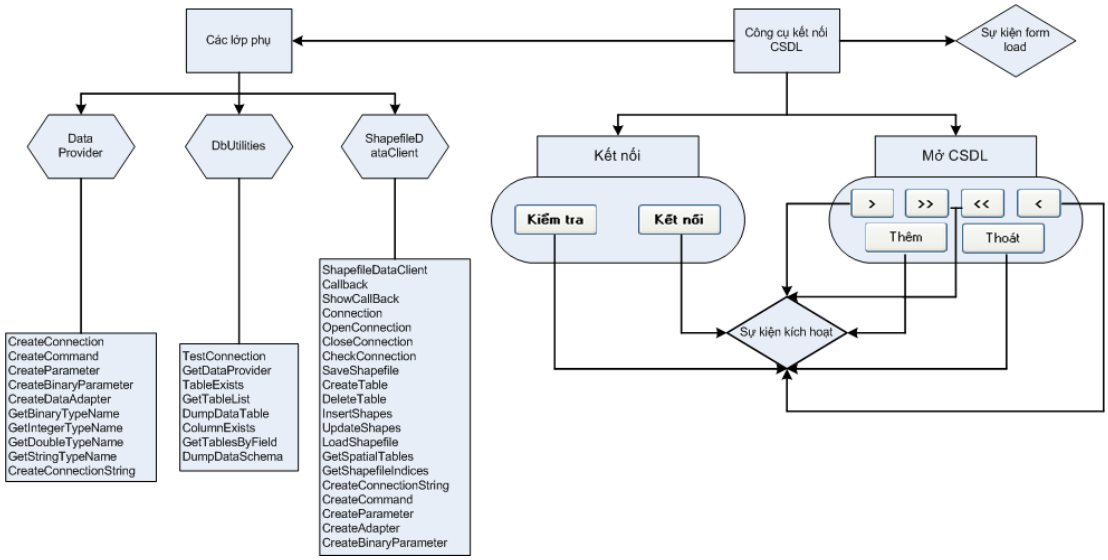

Figure 1. PostGIS database connection tool's structure diagram.

PostGIS database connection tool is designed with these main components:

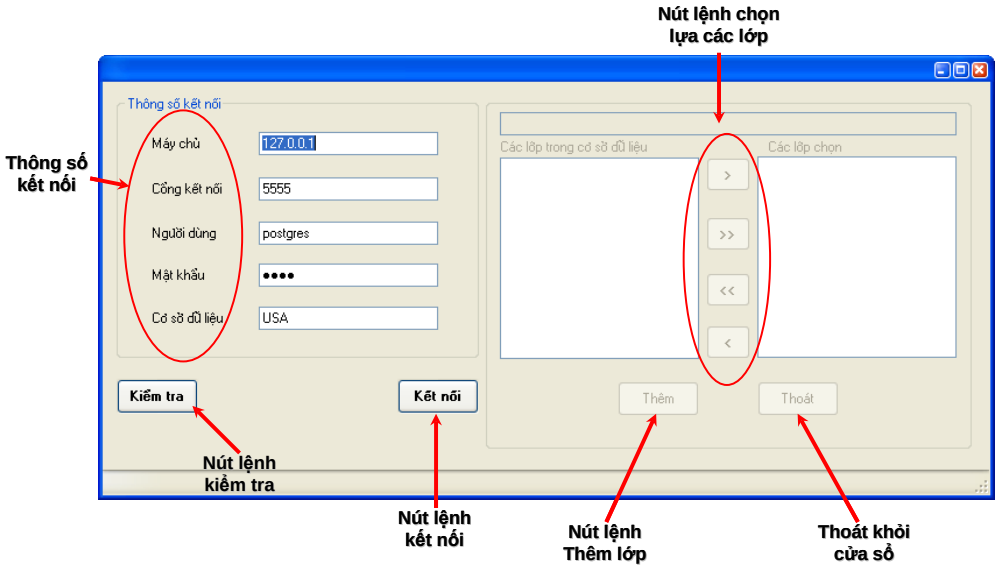

Figure 2. PostGIS database connection's interface

The parameters to connect to PostGIS: server name, port number, user name, user password and database name.

3.4 Software's interface designing

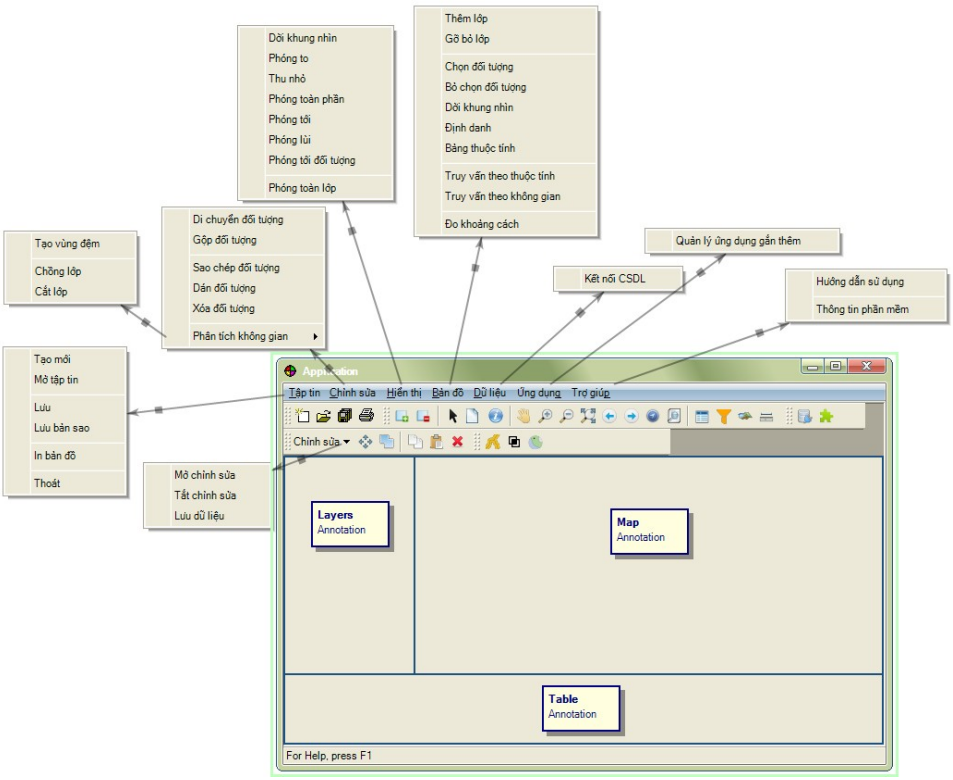

Figure 3. Software's functions

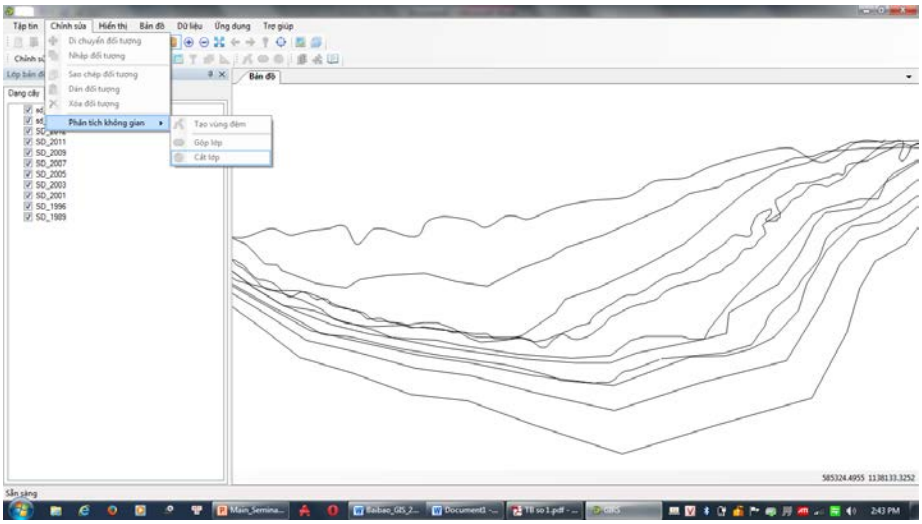

Figure 4. IRGOG's main interface.

3.5 Assessment

Vietnamese GIS desktop software IRGOG is designed to serve the basic functions for manipulating maps and database management connection. With the combination of open source libraries in this study, the research team provided the ability to build GIS applications with many new features, support new interface standard of Windows operating systems, support the spatial graphics standard of OGS. The prominent point of this application is the ability to Vietnameselize of the interface as well as other components of the library to be able to create an totally free and Vietnamese IRGOG.

The software was designed on the Microsoft .NET platform, which is the characteristic of this platform is not only the independence language supporting, but also language integration, it means users can inherit from many classes, debug catching, take advantage of the polymorphism through different languages. This helps in the development and expansion of the system very conveniently. The software can be applied in teaching in secondary school, high school, in the search for geographical information, maps ... and serve different users want to search for thematic maps, ...

However, this is still not the final product, so there are some limitations. such as: (1) the interface is not as friendly as commercial products; (2) some intensive functions such as network analysis functions, create and extract data for reporting functions has not been made; (3) compared with other libraries such as Openlayer, MapServer, Geoserver, the SharpMap's map viewing toolbar is not flexible, but still have the full features for map viewing.

4 CONCLUSION

The designing of GIS desktop software IRGOG with basic features based on open source code, the interface entirely in Vietnamese, meaningful and practical in universalizing GIS to many users in community, especially with the ability to cater for the secondary school, high school in teaching. On the other hand, it is also a potential research directions, contributing to all the technology in the field of GIS.

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