



**UNIVERSITI PUTRA MALAYSIA**

**DEVELOPMENT OF A SPATIAL WEB-BASED GRAPHICAL USER  
INTERFACE WITH GIS FOR REAL ESTATE USERS**

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INTERFACE WITH GIS FOR REAL ESTATE USERS**

**By**

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**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in  
Fulfilment of the Requirements for the Degree of Master of Science**

**November 2007**



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in partial fulfilment of the requirement for the degree of Master of Science

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**Faculty : Engineering**

Geographic information is a valuable source for applications and analysis, where location of objects and events, can enhance the decision making activities. Recently, the interoperability of geospatial data has been an ongoing research activity and goal of the geospatial information user community for decades. Focusing on data integration scenarios, the recent popularity and adoption of the internet and web services, has provided a new means of interoperability for geospatial information, differing from previous approaches to information exchange.

Currently the interoperability approaches of geospatial information with real estate data are inadequate. This thesis argues that utilizing the interoperability real estate data, with geospatial data using web services, is the best method to achieve efficient data exchange than traditional approaches. The thesis demonstrates this by



developing a spatial web service to facilitate transferring data, from real estate users, to Geographic Information System (GIS) data layers. The thesis also discusses how web services affect data preparation and data updating. Various scenarios of geocoding and transferring real estate data into geospatial data will be discussed.

A web interface implementation is presented, to illustrate the validity of the interoperable spatial web service approach, with real estate for which this thesis argues. The interface has two ways communication. On one hand users will be able to use the spatial web service to integrate the property data, with GIS service provider. On the other hand, user will be able to receive a map report for the geocoded property.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi sebahagian keperluan untuk ijazah Master Sains

**PEMBANGUNAN PENGANTARAMUKAAN SPATIAL BERASASKAN WEB  
DENGAN GIS UNTUK PENGGUNA-PENGGUNA HARTANAH**

Oleh

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Maklumat geografi adalah sumber yang penting bagi analisis, di mana lokasi objek dan kejadian boleh membantu dalam membuat keputusan polisi. Baru-baru ini keberinteroperasian data geospasial telah menjadi penyal-dekan semasa dan impian puluhan tahun kepada komuniti matlamat masyarakat pengguna maklumat geospasial. Menumpu kepada senario integrasi data, populariti dan penggunaan internet yang kan meluas serta khidmat web telah memberikan suatu lagi kaedah keberinteroperasian yang baru bagi maklumat geospasial, yang berbeza dengan pendekatan dahulu dalam pertukaran maklumat.

Kaedah biasa dalam keberinteroperasian maklumat geospasial dengan maklumat hartanah tidak memadai. Tesis ini mengemukakan bahawa menggunakan data hartanah berinteroperasi adalah cara yang paling bagus untuk mencapai pertukaran data yang lebih cekap berbanding kaedah tradisional. Tesis ini menunjukkannya



dengan mengembangkan sebuah khidmat web spatial untuk memudahkan pemindahan data, daripada pengguna hartanah, kepada lapisan data Sistem Maklumat Geografi. Tesis ini juga membincangkan bagaimana khidmat web memberi kesan terhadap penyediaan data serta kemaskini data. Pelbagai senario geokod dan pemindahan data hartanah kepada data geospasial akan dibincangkan.

Perlaksanaan antaramuka web dikemukakan untuk memperlihatkan kesahihan pendekatan khidmat web spatial dengan hartanah, seperti mana dibahaskan oleh tesis ini. Antaramuka ini mempunyai dua kaedah komunikasi. Pengguna boleh menggunakan khidmat web spatial untuk mengintegrasikan data hartanahnya, dengan pemberi khidmat GIS. Selain itu, pengguna juga boleh menerima laporan peta untuk hartanah yang telah digeokod.

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I certify that an Examination Committee has met on 30 November 2007 to conduct the final examination of Mahmoud Fawzi Abdallah Alhader on his Master of Science thesis entitled “Development of a Spatial Web-Based Graphical User Interface with GIS for Real Estate Users” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the student be awarded the degree of Master of Science.

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## DECLARATION

I hereby declare that the thesis is based on my original work except that for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.



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**MAHMOUD FAWZI AL-HADER**

Date: Jan 13<sup>th</sup> 2008

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## LIST OF ABBREVIATIONS

GIS	Geographic Information System
XML	Extensible Markup Language
ESRI	Environmental Systems Research Institute
POI	Point of Interest
WGS	World Geodetic System
UTM	Universal Transverse Mercator
ArcIMS	Internet Map Service
ASP	Active Server Pages
VBScript	Visual Basic Script
R&D	Research and Development
GML	Geography Markup Language
SVG	Scalable Vector Graphics
WFS	Web Feature Service
OGC	OpenGIS Consortium
CORBA	Common Object Request Broker Architecture
GUI	Graphical User Interface
VR	Virtual Reality
VRML	Virtual Reality Modeling Language
CGI	Common Gateway Interface
HTML	Hyper Text Markup Language
SCET	Service Composition and Execution Tool
WSFL	Web Service Flow Language
VS.NET	Visual Studio.NET
SOAP	Simple Object Access Protocol



RPC	Remote Procedure Call
DCOM	Distributed Component Object Model
RDBMS	Relational Database Management System
JSP	Java Script Pages
API	Application Program Interface
J2EE	Java 2 Platform, Enterprise Edition
RS	Remote Sensing
GPS	Global Positioning System
WSDL	Web Services Description Language
UDDI	Universal description, discovery and integration
CPU	Central Processing Unit
CAD	Computer Aided Design
WCS	Web Coverage Service
WFS	Web Feature Service
LBS	Location Based Services
CPS	Coverage Portrayal Service
ASP	Application Service Providers
RBS	Rule-Based System
LAN	Local Area Network
CBD	Central Business District
MRA	Multiple Regression Analysis
SQL	Structured Query Language
BCSR	Bahrain Center for Studies and Research
CIO	Central Information Organization
NAD	National Address Database



GDF	Geographic Data Format
Web ADF	Web Application Development Frameworks
COM	Component Object Model
DLL	Dynamic Link Library
GDB	ESRI Geo Database
URL	Universal Resource Locator
DBF	DataBase Format
PDA	Personal Digital Assistant
GDMS	GIS Data Management System
MIS	Management Information System
3G	Third Generation of mobile technologies



# CHAPTER 1

## INTRODUCTION

### 1.1 Overview

During the last decades, real estate has become a major economical factor in the development of countries. On the other hand, real estate data can be managed as spatial features. Therefore, there is a need to present properties using GIS (Geographic Information System) to be more valuable information.

Since the GIS is a system used to visualize and analyze the spatial features, the interfacing between GIS and real estate is quite feasible. Spatial web services will facilitate real estate users, to integrate their property location data with GIS service provider via web. Two main functions are developed; the first function for integrating GIS data layers with data available with users, for allowing them to upload their property coordinates. The property can be either land (without address assigned), or constructed property (address assigned to it) like home and villa. Users need to upload the address of constructed properties, and beacon coordinates of the land. Then web service will take care of creating the geometric feature representation (such as geocoding or address matching).

The second function is developed for requesting map report. This is a technological approach allowing users to request information such as map report. In the case the user



need to specify certain parameters related to the map. Some parameters may be used to request a map report via spatial web service, such as map extent, scale, center coordinates, area name, and building address.

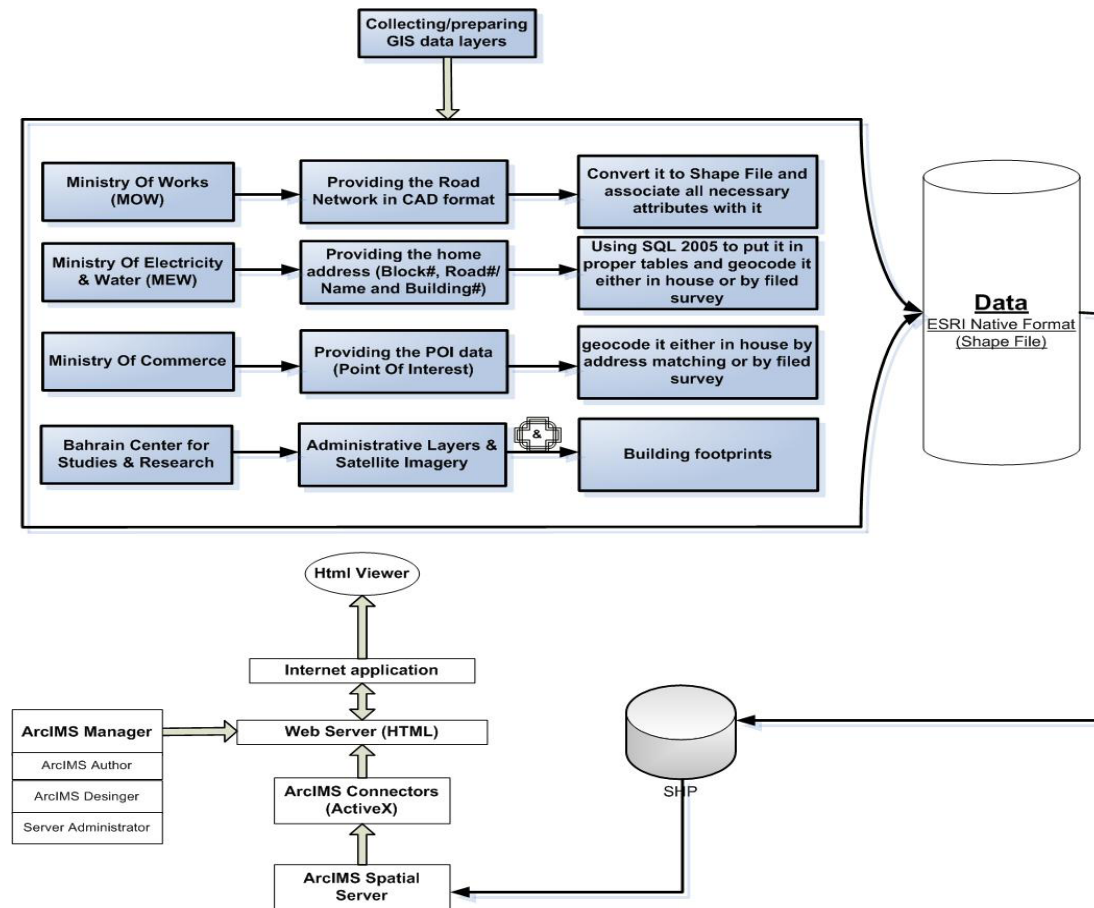
Web services are a proper solution for the integration among distinct systems, specially the debatable systems in terms of format and platform. Therefore, the new trend of systems integrations are currently done through the web. Extensible Markup Language (XML) is one of the best solutions to develop a technology to interface both real estate properties with the GIS geospatial data. While both systems have potential relationship with ground (geographical presentation), thus the web service is termed as spatial web service.

## **1.2 Overview of GIS Data Layers Preparation**

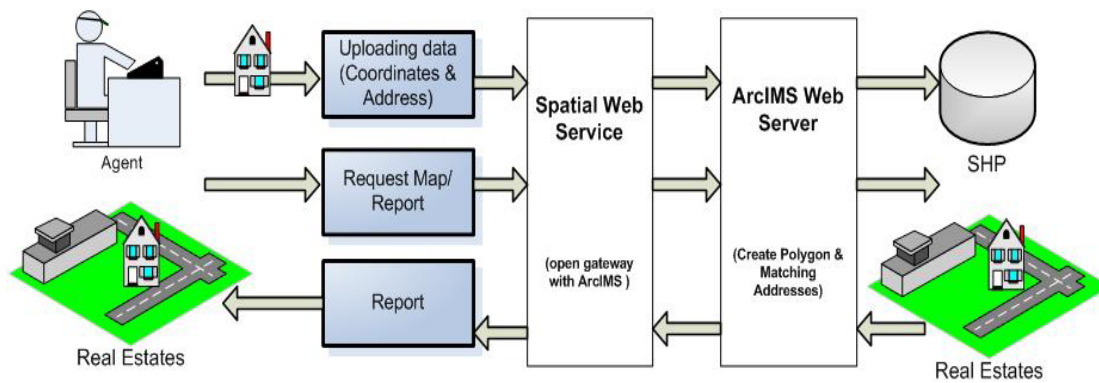
Preparing and collecting GIS data layers is government responsibility. Data is the critical path in this kind of applications, that developed based on data usability. Data is the most expensive, and time consuming in most of GIS applications. Therefore, government should host both, GIS server applications, and all developed internet mapping services.

ESRI GIS data structure (shapefile), used to facilitate the mapping analytical tools, and to enhance the performance for the updating, and requesting the mapping report. Figure 1.1 shows the procedure of data collecting, and data consolidation between distinct governmental establishments.

Interfacing spatial web services, with real estate clearly illustrated in Figure 1.2. The property needs to be updated, either in beacon coordinates for lands, or in address for constructed properties, such a villa or home. Users able to use spatial web service, to upload property locational parameters.



**Figure 1.1 Procedure of collecting and preparing GIS data layers in Bahrain**



**Figure 1.2 Interfacing spatial web services with real estate**

### 1.3 Problem Statements

The efficient data update procedure is extremely important in any any geospatial organization dealing with intelligent GIS data. Due to the importance of the GIS data in any geospatial application, that considered as the core of the applicaiton. It needs dedicated efforts and financial resources. After making data intelligent and GIS ready, these organizations provide the GIS data to other end user companies or organizations. Also as per the license agreement, data producing organizations, update the database at a regular time interval, and provide the same to end users. This data transfer process needs special attention and means extra overheads to both data providers and data users.

Intelligent GIS data is a great analysis tool, for the presentation and supporting decision making in extensive disciplines such as real estate systems. On the other hand, by monitoring the number of transactions related to real estate, either, in selling, or in renting distinct types of properties. Especially in those countries which are very active in construction, and in land development. It is clearly investigated that the investment gets



widespread in investing, both locally and internationally (Yoon *et al*, 2006). Therefore, the needful to obviously recognize property much closer, and crystal clear, is one of the critical and essential issues in any property transaction.

At the time being, most of developed systems, tried to represent properties using photos, and map locations or schemas. To realize the announced property as much as possible, in order to amend the investor's decision making. The decision either to accept the property, or to reject it, but still there are so many important, and essential criteria's effects the decision of property acceptance. Some of criteria's related to property location, availability of services, and simplicity of transportation to and from that particular property. The closeness from the trade, education, and medical centers within the property area is also important. All of these criteria's are extremely important in the sense of property purchasing value.

This research is creating a new technique using web services to solve the bad interfacing between the GIS and real estate data. Hence, web services provide kind of channel among real estate service provider, with several categories of users, along suitable interfacing with GIS data. Due to spatially nature of real estate features, therefore real estate can be presented on the ground and can be integrated with the web services. Web services are feasible enough, to integrate property data with GIS service provider. Spatial web services will make properties more viewable/presentable by locating the property on adequate digital mapping system (GIS).