

DEVELOPMENT OF WEB-BASED GIS FOR MARINE DATA INFORMATION

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Abstract

Geographic Information System (GIS) is the main components in hydrography technology especially in navigation purpose. This paper summarizes the principal components of WebGIS and geodatabase for nautical chart providing map and data services. The term WebGIS or Web-based GIS denotes a type of Geographic Information System (GIS), whose client is implemented in a web browser. In addition, a web-based GIS facilitates and share the data globally, provide end-users a cost-saving solution to access and update spatial datasets from time to time if there are new changes identified. The data acquired is in vector format which it digitized from paper chart. Furthermore, a web-enable GIS based on ArcIMS (Internet Map Server) software was used which is extended to using ArcView as a tool to develop database, VBscript and ASP to customize the application.

Keywords: hydrography, nautical chart, GIS

1.0 Introduction

A Geographic Information Systems (GIS) is a system for capturing, storing, analyzing and managing data, which are spatially referenced to the earth and displays geographical information of two types, vector or raster. GIS also allow users to select different layers of information to construct a map.

Until quite recently, most applications of GIS have focused on land based studies rather than marine environment. As in land based GIS application, Marine GIS application requires input in the form of a map of a water area (nautical chart or navigational chart). The nautical charts are essential tools for marine navigation and it may take the form of paper charts or Electronic Navigational Chart (ENC). Furthermore, navigation at sea requires safety under IMO/IHO regulations standard, which in navigational chart shows various aid to navigation and symbols for safe navigation to mariners. With greater quantities of marine and coastal data being acquired today, there are urgent need for centralized repository to share geospatial data and information of the chart via the internet.

There are several terms in describing GIS programs based on the internet such as Internet GIS (Peng 1999, Peng & Beimbom,1998), GIS on-line, Distributed Geographic Information (DGI) (Plewe,1997) and web-based GIS or Web GIS. The terms are seems to be similar, but have

different meanings. The internet is any networks composed of multiple, geographically dispersed networks connected through communication devices and a common set of communication protocols (Hall, 1994). Therefore, Internet GIS refers to the use of the Internet to exchange data, perform GIS analysis and present results whereas web-based GIS refers to WWW (World Wide Web) which is a networking application supporting a Hypertext Transfer Protocol (HTTP) that runs on top of the Internet (Peng & Tsou 2003). Both Internet GIS and Web based GIS use the client/server computing model. However, the term Internet GIS has a broader and more enduring meaning than web-based GIS. In other words, the internet is an infrastructure that hosts many applications including the web. Plewe (1997) points out that a Distributed GI refers to the use of Internet technologies to distribute geographic information in a variety of forms, including map, images, data sets, analysis separations and reports.

In this research, the nautical chart web based will be develop and disseminate as internet mapping. The users can access and updates the charts from time to time if there are new changes identified. Web GIS provides end-users a cost saving solutions to access up-to-date spatial datasets and information (Horanont et al., 2002 ; Painho et al., 2001). A web GIS is designed with tools and features that are common on web pages and it is therefore easy to understand for users familiar with the Internet (Nelson, 2002).

2.0 Methodology

The study area will covered Johor Bahru straits and in the form of nautical chart in raster format, based from Royal Malaysia Navy (RMN) nautical chart. Therefore, all charts are digitized into vector format in order to develop the applications. The ArcView software was used to develop the database. Figure 1 and Figure 2 below shows the examples of queries and the results of queries. According to the figure below, the analysis shows location or area of depth greater than 10.2 meters.

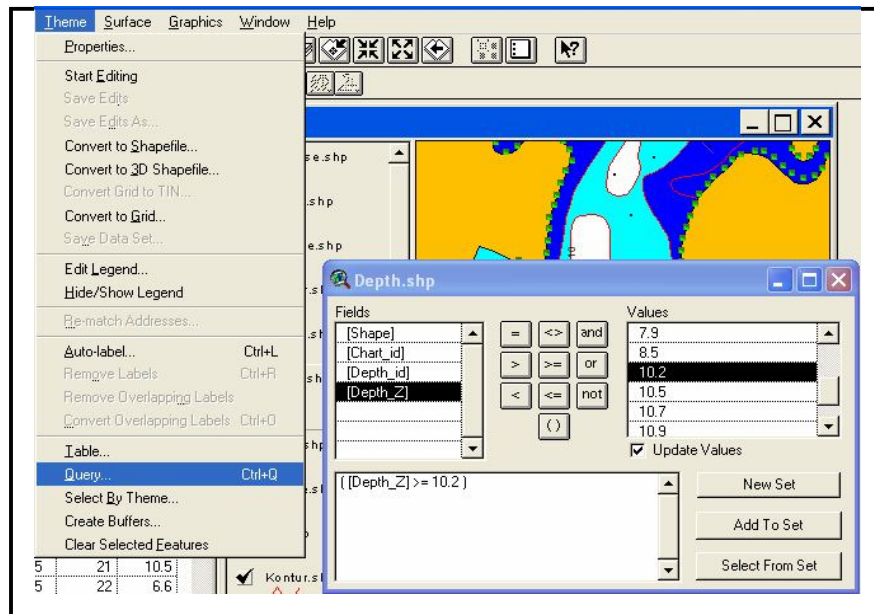


Figure 1: Example of queries

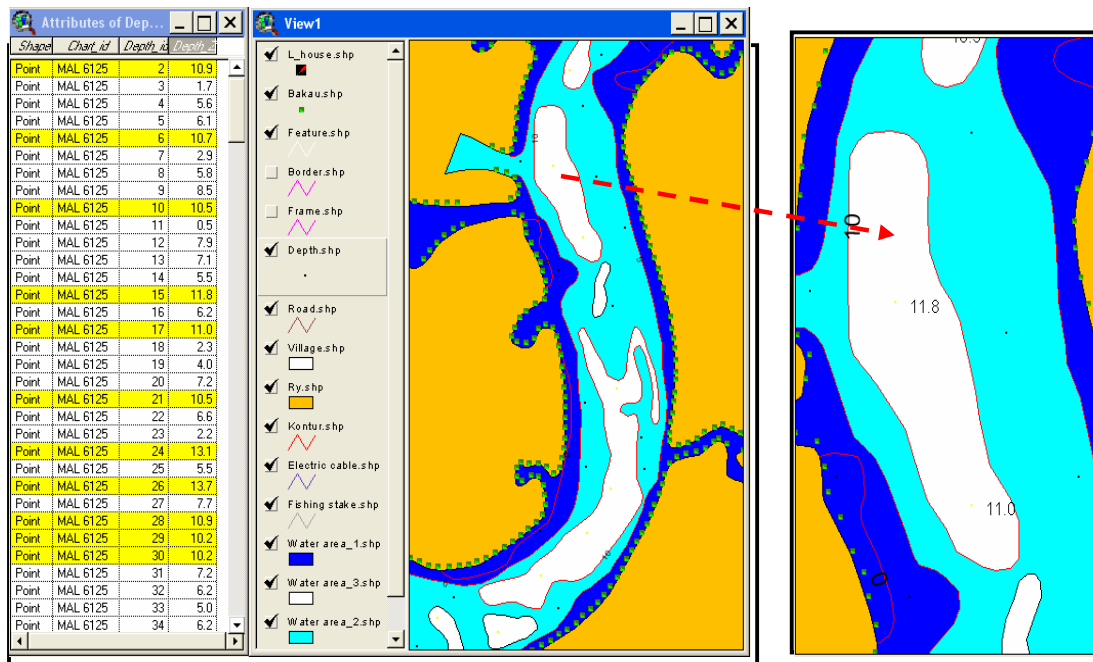


Figure 2: Example results of queries

Based on the results, the information can be queried through the Internet Map Server, or copied and downloaded to a local computer for more in-depth analysis. The technology used allows for rapid implementation that will be helpful in making up-to-date information immediately understandable and accessible through the Internet.

3.0 Web-Based GIS

In order to develop Web enable GIS, the minimum requirement is to have a map server. It acts as middleware software in the Internet or Intranet GIS application. ArcIMS (Arc Internet Map Server) was chosen as a map server in this research. Moreover, users can access these services through their Web browsers using HTML or Java applications that are included with ArcIMS. Figure 3 below shows the ArcIMS architecture:

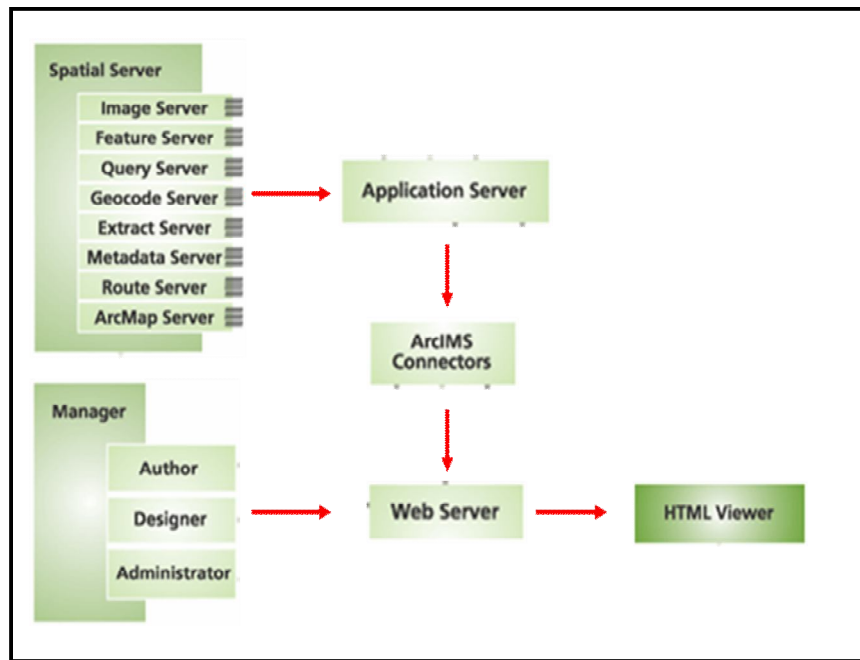


Figure 3: ArcIMS Architecture Overview

The graphic above shows the client/server side components. The server side component includes the web server, ArcIMS application server, ArcIMS application connectors, ArcIMS spatial server and ArcIMS Manager. The web server will receive and process user's requests such as data, information, mapping modules or even analysis tools. Next, the Web server will pass the parameters to the application server for retrieving the related data from the database. Then, it will pass the result to the Web server after retrieving data and sends to the end users.

According to Peng and Tsou (2003), the application server handles the load distribution of incoming requests and allocates which map services are running to the appropriate spatial server. Therefore, the application server connectors are used as a communication between the web server and the application server. There are a few connectors that offer in ArcIMS which is Servlet connector, ColdFusion connector, ActiveX connector and Java connector. Servlet connector is a standard connector in ArcIMS. It uses the ArcIMS language, ArcXML to communicate from the web server to ArcIMS Application Server. In addition, ActiveX Connector is also used in this research, which it works with custom clients and translate their own languages into ArcIMS. However, ActiveX works only with Microsoft Internet Explorer on Windows systems. Furthermore, the ArcIMS spatial server processes requests for maps and related information such as produce maps, access data, and bundle maps into an appropriate format.

The ArcIMS Manager provides access to all ArcIMS server side functions and tools. It consists of Author, Designer and Administrator. The ArcIMS Author used to create a map for the web site such as adding data layer, setting layer symbology and others. The ArcIMS Designer is used to design a web sites and ArcIMS Administrator is used to publish and administer the services. As a result, Web GIS will be published and distributed via the Internet.

4.0 Conclusions

As a conclusion, Geographic Information Systems (GIS) was implemented prior to meet the objective of this research, which is to develop an interactive WebGIS and geodatabase for nautical chart providing map and data services. WebGIS have the potential to share the data and provide

easy access for users with limited GIS knowledge. In order to develop the application, ArcIMS (Arc Internet Map Server) is used as a map server, which was extended using ArcGIS to develop a database, whereas VB script and ASP are needed for the web customization.

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