

Web – Based GIS for Tourist Guide with SMS / MMS Technology

By

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Dissertation submitted in partial fulfillment of
the requirements for the
Bachelor of Technology (Hons)
(Information System)

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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Information System Programme
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Approved by,



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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.



NUR HAZWANI BINTI MOHAMAD ROSELI

ABSTRACT

Web Based GIS is a system that combines two applications which are wireless communication and web site application. The main objectives of the system are to ease tourist in finding certain location in Malacca and to also to help them to access to the required location in a shortest period of time. Other objectives are to develop a system that is accessible to the user in terms of location and computer technology that are used, to develop a system that can provide accurate location and information for tourist, to help administrator in order to monitor the system and to develop a user-friendly interface or system by applying HCI elements. Usually, people view map using paper map and this process is inefficient and will cost a lot of time in finding the paper map. Besides, it is difficult for the tourist to find certain location in a state. It consumes a lot of times in looking the location that we want without having any idea where the location is. The scope of this project is only limited to Malacca. The system will focus on Bandar Malacca's map and information concerning the map. Other than that, there is a research about Web Based GIS and ArcIMS (system requirements, the best viewers, publish data on website). Waterfall model has been chosen as the methodology in developing this system.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Currently, life and work encounter new challenges and problems, such as the lack of time, disaster management and online management, which GIS can help to overcome. GIS is a computer system capable of capturing, storing, analyzing and displaying geographically referenced information which is data identified according to location. GIS lends a hand with powerful visualization tools and functioning to present data in many ways. Making maps with GIS is much more flexible than traditional manual or automated cartography approaches. A GIS creates maps from data pulled from databases. Existing paper maps can be digitized and translated into the GIS as well. A GIS can use data from a wide range of proprietary and standard map and graphics file formats, images, CAD files, spreadsheets, relational databases, and many more sources.

Web-based GIS for Tourist Guide is developed especially for the tourist to find location that they want. With web based GIS, data can be easily transmitted via Internet. ArcIMS is the solution for delivering dynamic maps and GIS data and services via the internet. ArcIMS provides Web publishing of GIS maps, data, and metadata for access by many users both inside the organization and outside on the World Wide Web. With ArcIMS, we can easily create, design and manage web sites. Many organizations publish GIS data for GIS professionals both within and outside their organization. Such ArcIMS applications are focused on data sharing between GIS professionals. GIS Web publishing with ArcIMS is often the initial step in the implementation of enterprise GIS. ArcIMS includes tools for

building a GIS Portal with a metadata catalog such as search and discovery, data and metadata harvesting, gazetter functions and web mapping applications.

1.2 Problem Statement

1.2.1 Problem Identification

Normally, people view map using paper map. They have to find these maps in the Tourist Information Center. This process is inefficient and will cost a lot of time traveling to Tourist Information Center. Other than that it is difficult for the tourist to find certain location in a state. It consumes a lot of times in searching the location that we want without having any idea where the location is.

1.2.2 Significance of the Project

The significant of the project are as follow:

- i) Publish high-quality interactive maps that can be accessed through internet.
- ii) Serve as a medium to help tourist to find certain locations in Malacca.
- iii) Reduce time to find paper map.
- iv) Implement GIS websites.

1.3 Objective

The objectives that must be accomplished by the end of this project are as follow :

- i) To study the underlying concept of GIS
- ii) To develop a system that is accessible to the user in terms of location and computer technology that are used.
- iii) To develop a system that can provide accurate location and information for tourist.
- iv) To help administrator in order to monitor the system.

1.4 Scope of Study

The project scope includes the study of GIS, Web Based GIS, and ArcIMS. How GIS data can be transferred via Internet. How Web Based GIS can help in delivering data over the web. How ArcIMS can help in distributing GIS services and data over the web. The system will be using Bandar Malacca's data as a scope of study.

CHAPTER 2

LITERATURE REVIEW AND THEORY

2.1 Introduction to Geographical Information System (GIS)

"GIS is evolving from a database approach to a knowledge approach." (ESRI President Jack Dangemond, July 2003). GIS is computer software that links geographic information (where things are) with descriptive information (what things are). Unlike a flat paper map, where "what you see is what you get," a GIS can present many layers of different information (ESRI White Paper, September 2002). Besides A GIS is a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information; that is, data identified according to location. Practitioners also define a GIS as including the procedures, operating personnel, and spatial data that go into the system (U.S Geological Survey, 30 July 2004). GIS is an integrated system of computer hardware, software, and trained personnel linking topographic, demographic, utility, facility, image and other resource data that is geographically referenced (NASA).

Other than that, geographic information system (GIS) is a system for management, analysis, and display of geographic knowledge, which is represented using a series of information sets. The information sets include maps and globes, geographic data sets, processing and work flow models, data models and metadata (ESRI.com). The explanations of these information sets are as below:

i) Maps and Globes

Interactive views of geographic data with which to answer questions, present results, and use as a dashboard for real work. Maps and globes provide the advanced GIS applications for interacting with geographic data.

ii) Geographic Data Sets

File bases and databases of geographic information which are features, networks, topologies, terrains, surveys, and attributes.

iii) Processing and Work Flow Models

Collections of geoprocessing procedures for automating and repeating numerous tasks and for analysis.

iv) Data Models

GIS data sets are more than database management system (DBMS) tables. They incorporate advanced behavior and integrity like other information systems. The schema, behavior, and integrity rules of geographic data sets play a critical role in GIS.

v) Metadata

Documents describing the other elements. A document catalog enables users to organize, discover, and gain access to shared geographic knowledge.

GIS is a rapidly growing technological field that incorporates graphical features with tabular data in order to assess real-world problems. There are four major components of GIS which are hardware, software, data and people (GISLounge, 2004) :

i) Hardware

Hardware comprises the equipment needed to support the many activities of GIS ranging from data collection to data analysis. The central piece of equipment is the workstation, which runs the GIS software and is the attachment point for ancillary equipment. Data collection efforts can also require the use of a digitizer for conversion of hard copy data to digital data and a GPS data logger to collect data in the field. The use of handheld field technology is also becoming an important data collection tool in GIS. With the advent of web-enabled GIS, web servers have also become an important piece of equipment for GIS.

ii) Software

Different software packages are important for GIS. Central to this is the GIS application package. Such software is essential for creating, editing and analyzing spatial and attributes data, therefore these packages contain a myriad of GIS functions inherent to them. Extensions or add-ons are software that extends the capabilities of the GIS software package. For example, XTools is an ArcView extension that adds more editing capabilities to ArcView 3.x. Component GIS software is the opposite of application software. Components GIS seeks to build software applications that meet a specific purpose and thus are limited in their spatial analysis capabilities. Utilities are stand-alone programs that perform a specific function. For example, a file format utility that converts from one type of GIS file to another. There is also web-GIS software that helps serve data through Internet browsers.

iii) Data

Data is the core of any GIS. There are two primary types of data that are used in GIS. A geodatabase is a database that is in some way referenced to locations on the earth. Geodatabases are grouped into two different types: vector and raster. Coupled with this data is usually data known as attribute data. Attribute data generally defined as additional information, which can then be tied to spatial data. Documentation of GIS datasets is known as metadata.

iv) People

Well-trained people knowledgeable in spatial analysis and skilled in using GIS software are essential to the GIS process. There are three factors to the people component which are education, career path, and networking.

2.2 Web-Based GIS

Web-Based GIS means putting GIS on the web. The Web enables geographic information to be shared and distributed quickly and cost effectively. Web-based GISs give users GIS functionality through their Web browser. Experts identify and develop the optimum in Web-based GIS solutions using a variety of application development tools such as ArcIMS, MapGuide, XML, JavaScript, JSP, ASP, and others (Eagen, McAllister Associates, Inc., 2004). There are lots of advantages of WEB based GIS. With this technology we can have centralized base-map data which are large enough to be on individual systems. When the GIS data is centralized it can be managed more easily and everyone has access to changes as soon as they are updated. Individuals need only standard Web Servers to run the application. (Asima Mishra, MTS, Geomatics Group).

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The web based GIS software mainly consists of two components which are the server and web client, which run the browser. The server is a set of applications that serves the request of the clients. The web client is the general user who performs an information retrieval operation, the server identifies user by logging into the system. The server validates and lists all projects meant for information display. The user can select a project and start working on the spatial and non-spatial data associated with the project. There are two basic approaches to implement GIS in the web. The

two basic approaches are server-side applications and client-side applications (Asima Mishra, MTG, Geomatics Group).

i) Server-Side Applications

An Internet GIS server usually combines a standard Web (HTTP) server and a GIS application server. Here all the complex and proprietary software as well as the GIS databases reside on a server that's administered by the deploying organization. Having applications centralized on one or a few machines significantly simplifies development, deployment and maintenance. The Web server passes the request to a GIS application server which runs an address-matching routine, generates a map graphic, converts the graphic to Web format, wraps the image in HTML and sends it back to the Web server which then returns the response to the client as a standard Web page.

ii) Client-Side Applications

In client-side Internet GIS, the client is enhanced to support GIS operations. Some systems move a substantial amount of GIS functionality to the client, and some only enhance the user interface slightly. Client-side solutions typically are implemented by augmenting the Web browser with Java, ActiveX or plug-ins. However, some client-side solutions require users to install a complete client application. But to implement client-side solutions of any kind, software must be transferred to users.

There are three approaches to web-based GIS to publish maps on the internet. The approaches are by using ArcIMS, ArcWeb services and Route MAP IMS. ArcIMS provides the framework for distributing GIS services on the internet. ArcIMS adds geographic data such as diverse applications as e-commerce, enterprise resource planning (ERP), data warehousing, customization support, location-based services, and field data integration. Besides, ArcWeb Services offer a way to include GIS content and capabilities in our applications without having to develop the necessary tools ourselves. Meanwhile, Route MAP IMS is a business tool for providing internet mapping and location services (Sourcegroup.com).

“Commercial software packages such as ArcIMS, are now available to construct web-based GIS systems” (Research done by Ron Li, Xutong Nin, Tarig Ali, Ruijin Ma, Ahmed Elaksher, John Watkins, Justin Reinhart, Don Guy).

2.3 ArcIMS

ArcIMS is a server-based product that provides a scalable framework for distributing GIS services and data over the Web. ArcIMS provides Web publishing of GIS maps, data, and metadata for access by many users both inside the organization and outside on the World Wide Web. ArcIMS enables Web sites to serve GIS data, interactive maps, metadata catalogs, and focused GIS applications. ArcIMS users access these services through their Web browsers using HTML or Java applications that are included with ArcIMS. In addition, ArcIMS services can be accessed using many different clients including ArcGIS Desktop, custom applications created using ArcGIS Engine, ArcReader, ArcPad, ArcGIS Server, MapObjects—Java Edition, and a wide variety of mobile and wireless devices (ESRI).

There are several advantages of using ArcIMS. The advantages are as below:

- i) Publish high-quality interactive maps that can be accessed by thousands of people simultaneously over the Internet.
- ii) Integrate data from multiple sources (Internet or local) and serve it on the Web.
- iii) Make your maps, data, and metadata accessible using a variety of clients (mobile, desktop, browser).
- iv) Use the highly scalable server architecture to accommodate growing demand for your services without having to rebuild applications.
- v) Create a central repository for publishing and browsing metadata.
- vi) Make your GIS content more accessible by publishing metadata about your services.

Furthermore, there are several key features of ArcIMS. The key features are easy to get started, GIS web publishing capabilities, ArcGIS integration, ability to use and

integrate data from multiple sources, scalable architecture, support for a variety of clients, ability to deliver an online metadata and standards-based.

i) Easy to get started

ArcIMS wizards and templates guide us through tasks for authoring and publishing map and no programming is required. The developer simply creates a map service, design the Web pages, and publish it. For more advanced users, client and server configuration and management tools are available for building secure, reliable, and highly scalable sites. Furthermore, the ArcIMS Site Starter applications are a set of Active Server Pages (ASP) applications that addresses a specific business function (such as a database search) and presents the user with an intuitive, step-by-step path to generating maps and reports. The Site Starter application clients are lightweight and graphically adaptable, offering a variety of presentation styles to choose from.

ii) GIS web publishing capabilities

There are a variety of GIS web publishing capabilities which are image rendering, feature streaming, data query, data extraction, geocoding and metadata.

iii) ArcGIS integration

Developer can publish any ArcGIS map document on the web by using ArcIMS ArcMap Server. With this, developer can take advantage of all the advanced data access and cartographic capabilities offered by ArcGIS authoring environment. The ArcMap Server functions are publish maps using ArcGIS advanced cartography, display map layouts including legends, graticules, and scale bars, support all data types supported by ArcGIS including geodatabases, coverage annotation, network data (dynamic segmentation), versioned layers in ArcSDE, and computer-aided design (CAD) drawing files (DGN, DWG, and DXF), and accomplish a variety of other tasks.

v) Ability to use and integrate data from multiple sources

ArcIMS offers powerful data integration capabilities so that users to access data, and then quickly and simply integrate it with data from many other Internet and local sources. ArcIMS provides support for a variety of different data types including shapefiles, coverages, ArcSDE layers, and a variety of image formats. Also, the ArcIMS ArcMap Server lets you publish your ArcGIS maps over the Internet. Users can navigate to a specific map location at any scale and print a map that takes advantage of the layout and cartographic capabilities of the ArcGIS Desktop authoring environment. ArcIMS ArcMap Server supports all data types supported by ArcGIS including geodatabases, coverage annotation, network data (dynamic segmentation), versioned layers in ArcSDE, and CAD drawing files (DGN, DWG, and DXF).

vi) Scalable architecture

ArcIMS is a completely scalable solution for publishing GIS data, maps, and applications. ArcIMS is designed so it can easily be scaled to handle the demands of everything from the smallest Intranet to a high-volume Internet site. ArcIMS establishes a common platform for the exchange of Web-enabled GIS data and services. ArcIMS server technology is part of a multitier architecture. The ArcIMS framework consists of clients, services, and data management. The wide variety of supported clients and the server potential are what set ArcIMS apart from other Internet GIS competitors.

vii) Support for a variety of clients

ArcIMS offers mapping capabilities and data to a variety of clients, ranging from wireless devices, such as cellular phones and personal digital assistants (PDAs), to lightweight browser-based clients to a full-featured GIS desktop client. ArcIMS comes with both HTML and Java client viewers.

viii) Ability to deliver an online metadata

ArcIMS Metadata Services can be used to create a central, online metadata repository to easily publish and browse metadata over the Internet. Metadata is optimized for rapid and efficient searches using a variety of clients including lightweight browser-based clients and ArcGIS Desktop. The ArcIMS Metadata Explorer, a JavaServer Pages (JSP) application, can be used to build a customized, browser-based means of searching for metadata. Searching for metadata is quick and efficient because users can perform searches based on any combination of geographic extent, content type, data format, or keyword. ArcIMS Metadata Services are part of the technology used to build GIS portals.

x) Standard-based

ArcIMS offers standards-based customization, integration and communication. ArcIMS can be customized and extended using industry-standard Web development environments such as JSP, ASP, .NET, ColdFusion, and others. ArcIMS can be integrated with other technologies in an organization to deliver a complete enterprise solution. ArcIMS clients and servers communicate using ArcXML, which is a GIS extension to standard Extensible Markup Language (XML). ArcXML also offers an easy way to customize ArcIMS applications.

2.4 Integration With SMS/MMS

Nowadays there are many applications that can integrate website with sms and mms. For an example by using ArcIMS and Autodesk Mapguide

2.5 Example Application Using Similar To This Project

Other application that is similar with ArcIMS is Autodesk MapGuide® 6.5. This software helps us to develop, manage, and distribute GIS and design applications on the Internet or intranet, broadening our access to mission-critical geospatial and digital design data. Autodesk MapGuide 6.5 can reduces cost, improve client and customer service, capitalize on our data investment, increase access to maps and

data, develop custom application and can send data across network or out to our mobile workforce.

CHAPTER 3

METHODOLOGY / FRAMEWORK

3.1 Procedure Identification : Waterfall Model

Waterfall model has been chosen as a methodology for this project. Waterfall model is widely used in development process and its development method is linear and sequential. Phases involved in this model are planning, analysis, design, development, testing. This project will go through all the phases. Below is the elaboration of each of the phases.

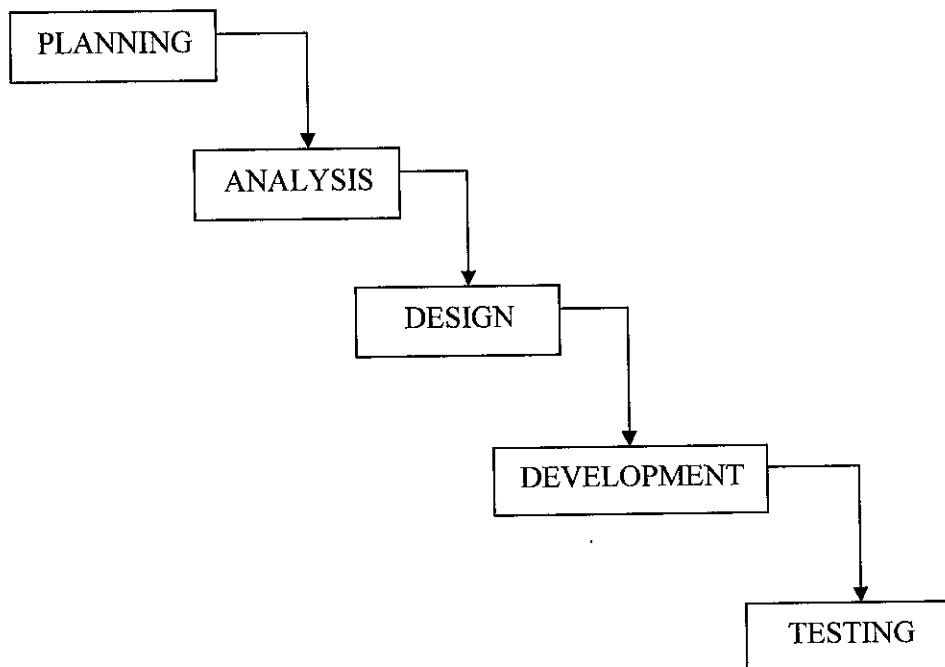


Figure 3.1 : Waterfall Model

3.1.1 Planning

The first stage of system development life cycle is planning. Planning involves identifying problems, objectives and determining project scope, project schedule and tools that are needed. Identifying problems, objectives and determining project scope are important because with this information, the author can know what are the problems arise. Therefore, the author can develop a system that can overcome the problems and achieve the objectives. Project schedule is to make sure that the project finished within the time given. Besides, the author also planned on how to gather and collect data so that the data that are gathered are correct. Other than that, the correct tools are determined and installed. Please refer to Section 3.2 to see a list of tools that are going to be used in the project. Planning is important because it will lead to the success of the development of the project.

3.1.2 Analysis

The second stage is analysis. This step refers to the analyzing all the data and information gathered and system requirements, with the goal of determining how these information and requirements will be accommodated in the system. Analysis methods that have been chosen are through a research. The author spent a lot of time in doing research studies on various journals, white papers, thesis, articles and also websites regarding the geographical information system (GIS), ArcIMS, web based application, integration between ArcIMS and SMS or MMS system and other related areas. Besides, the author also made a research in terms of hardware requirements, servlet engines and web browser that are suitable for ArcIMS 4.

Furthermore, the author also made a research concerning on how to publish data to the web. Distributing spatial and tabular attribute data over a Web-based network is a powerful and effective communication method but public agencies should carefully consider all the business and technical issues before starting out. There are some issues that developer often overlooked when implementing a Web-based GIS application. Below are the issues:

i) Know the technology

In general, viewing GIS data on the Web involves a three-tiered architecture:

1. A spatial server that can efficiently communicate with a Web server and is capable of sending and receiving requests for different types of data from a Web browser environment.
2. A mapping file format that can be embedded into a Web page.
3. A Web-based application in which maps can be viewed and queried by an end user or client via a Web browser.

The underlying issue is that developing a Web-based GIS application has many components including viewer and server-side application development. Typically, the level of required technical skills is beyond that of the traditional GIS professional. Thankfully, most Web-based GIS software products provide easy-to-use authoring tools that create the map and data query functionality. The developer of the Web application should add spatial data (vector and raster), sets scale display properties, sets rendering characteristics like line weights, thematic mapping, object labeling, and defines layer groups for the map legend. The map is then embedded into the Web page.

ii) Utilize intelligent CAD data

All CAD software has the ability to create and maintain spatial objects that have embedded attributes or that link directly to an external database. Also CAD software allows the creation and maintenance of spatial data in a real-world map coordinate system and the ability to classify and group object features.

iii) Publish data in its native format

Publishing data to the Web should not change the existing data workflow like how the data is created, maintained, and used by desktop applications. For example, many agencies have traditional GIS data for planning and archival purposes in addition to Digital Design Data (similar to CAD data) from engineers, surveyors, mappers, and infrastructure managers. Developers should choose the technical

platform that allows them to keep GIS data and Digital Design Data in its native format without translation or having to maintain yet another copy of that data. This will allow developer to keep their existing data management practices and procedures intact. In addition, developer should make sure that their Web solution allows the linking of external database tables to spatial layers and their objects. This allows for very flexible labeling, tooltips and reporting of the attributes of those objects.

iv) Maintain data integrity

Spatial data has a stated accuracy and precision. In addition, engineering and survey spatial data is typically defined as 3-D objects in the form of parametric curves and spirals. Choose a Web-publishing solution that preserves our data integrity and supports 3-D objects. It is best not to compromise our data to implement a Web-based mapping application.

v) Map projections

Often spatial data natively exists in different coordinate systems. An example would be survey data that is in latitude / longitude format and land parcel boundaries that are in UTM or state plane coordinates. Choose a GIS Web-publishing product that supports on-the-fly map projections.

vi) Provide intelligent data to the user

Robust Web data publishing products provide the ability to byte stream spatial objects direct to the browser. This functionality is provided by a browser plug-in – ActiveX for Microsoft Windows Explorer or Java for Netscape. The advantage of providing the spatial objects to the Web versus rendering a bitmap image includes high quality presentation graphics to the computer screen or print output and the ability to display object database content when the user hovers the cursor.

vii) Allow users to add their own data

Invariably it will occur that a user wants to add spatial or attribute data to a Web-based application or change display characteristics. The developers have to choose their Web based GIS software that will allow the user to perform this operation.

viii) Select standard and open development technologies

Develop Web-based applications using standard technologies such as HTML, XML, JavaScript, and COM. In addition, select a Web development platform that supports the Open GIS Consortium (OGC) and the Open Web Services 1.2 initiative that is focused on developing interface specifications in the areas of image handling, sensor Web enablement, service chaining, and feature handling.

ix) Develop for low bandwidth

Successful applications take advantage of networks with high bandwidth while working efficiently to avoid problems with slow networks and low bandwidth. Therefore, when choosing a Web-based GIS, scalability (the ability to take advantage of high bandwidth or compensate processes for low bandwidth) is critical. Developer should always develop for the slowest connection and be mindful of significantly low bandwidth wireless clients.

x) Data security

Developers have a considerable investment in their corporate data. Make sure to implement a solution that fully supports industry specifications for Secure Socket Layer (SSL) technology.

xi) Native database connectivity

GIS and Digital Design Data have attributes that can be managed and stored in a Relational Database Management System (RDBMS). Choose a Web publishing solution that supports a direct connection to the database using OLE DB or ODBC

compliant protocol. If storing spatial and attribute data in a RDBMS, make sure to implement an SQL-compliant solution that allows direct and open access from the Web application without using middleware.

Besides, the author also made a research in terms of ArcIMS security. Issues that are needed to consider regarding security matters are:

- i) security concerns of a typical ArcIMS installation
- ii) security with the ActiveX and Cold Fusion Connectors
- iii) leveraging web server security
- iv) firewalls and ArcIMS

3.1.3 Design

After all the requirements have been collected and analyzed, it is necessary to identify in detail how the system will be constructed to perform necessary task. It focused on the data requirements, the software construction and the interface development. At this phase, the author has designed a storyboard and framework of the system.

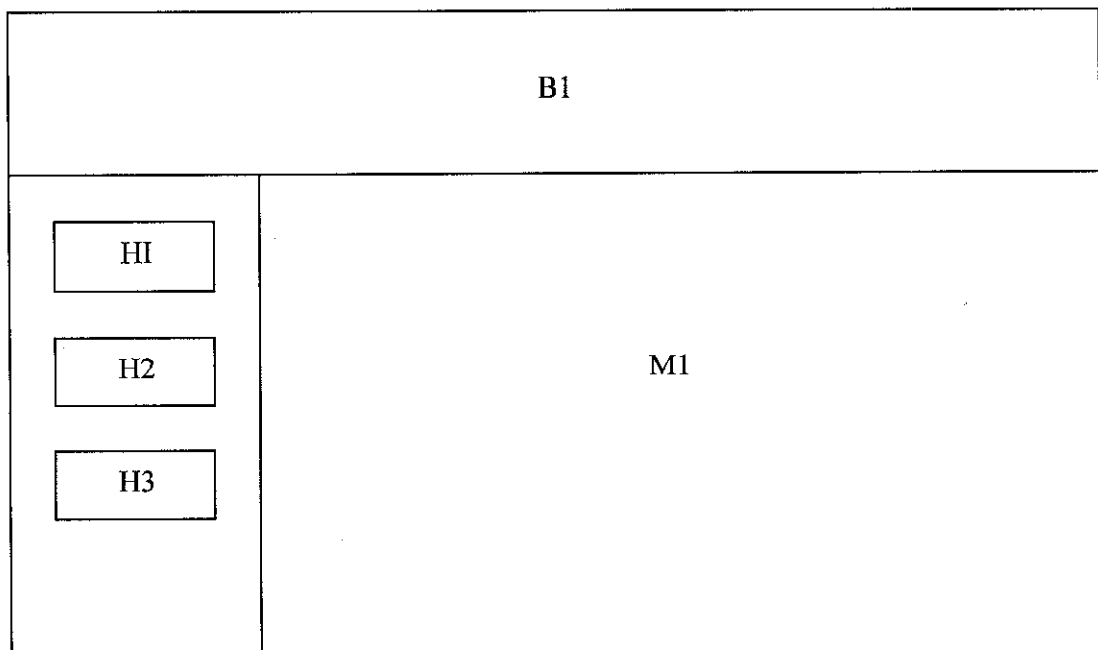


Figure 3.2 : Storyboard

Table 3.1 : Storyboard Label

B1	:	Banner
HI	:	Hyperlink to Introduction
H2	:	Hyperlink to Map
H3	:	Hyperlink to Administration Log In
M1	:	Map

This storyboard basically only the main idea on what the interfaces will look like. The author has changed the design so that it is more users friendly. The front page of the system shows the introduction of the system. This page links with other two pages which are for the administrator to log in the ArcIMS and the other one is for the user to view map and find information about Malacca (focus on Bandar Malacca only).

3.1.4 Development

The development of the project will be based on the previous phase. Here, we develop the system based on a information that had gathered and its interfaces are based on a storyboard.

3.1.5 Testing

Testing will be done during development phase and after developing the system. Testing is performed to ensure that it is working correctly and efficiently. Testing is generally focused on two areas which are internal efficiency and external effectiveness. The goal of internal testing is to make sure that the computer code is efficient, standardized, and well documented. Meanwhile, the goal of external effectiveness testing is to verify that the software is functioning according to system design.

iii) Adobe Photoshop 7

Adobe Photoshop 7 is used to design banner for the website.

iv) Windows 2000 Professional with Service Pack 3

3.2.2 Hardware

i) Computer

ii) Server - Internet Information Services 5.0.

Internet Information Services (IIS) is the Windows component that makes it easy to publish information and bring business application to the web. IIS makes it easy for us to create a strong platform for network applications and communications.

3.2.3 System Requirements for ArcIMS

For developing “Web-Based GIS for Tourist Guide” , the author has used ArcIMS software. Below are the software and hardware that the author has identified in order to install this software.

ArcIMS 4.0 with PC-Intel Windows 2000, Professional, Server, and Advanced Server on Internet Information Server 5.0

Table 3.3 : System Requirements for ArcIMS

Product	ArcIMS 4.0
Platform	PC - Intel
Operating System	Windows 2000, Professional, Server and Advanced Server
Service Pack/Patches	SP 2 or SP 3
Shipping/Release Date	April 1, 2002
Web Server	Internet Information Services
Web Server Version	5.0

i) Hardware Requirements

Swap Space:

300 MB minimum

Utilizing Windows Terminal Server technology may require additional MB, depending on the number of clients accessing the server.

Notes:

JRE with the Java Plug-in is required.

JRE 1.3.1_02 is supported.

JRE versions 1.3.1_03, 1.3.1_04, 1.4.0, and 1.4.0_01 are not supported.

JRE versions greater than 1.4.0_01 are unknown to work at this time.

ii) Supported Servlet Engines

- Jrun 3.0 sp2
- Jrun 3.1
- ServletExec 4.1.1
- Tomcat 3.2.x
- Tomcat 4.0.3
- Tomcat 4.0.5

iii) Supported Web Browsers

- Internet Explorer 5.0
- Internet Explorer 5.5
- Internet Explorer 6.0
- Netscape Communicator 4.75
Java Custom Viewer is not supported in the Netscape browser.
- Netscape Communicator 4.76
Java Custom Viewer is not supported in the Netscape browser.
- Netscape Communicator 6.0
Java Custom Viewer is not supported in the Netscape browser.

System requirements have to take into consideration when developer wants to use ArcIMS. The author had to make sure that her platform and hardware meets these requirements so that the author would not face any problems in terms of installing or using the software.

CHAPTER 4

RESULT AND DISCUSSION

Findings and results related to the author research and development of the system are shown in this section. The findings are about differences between Java Viewer and HTML Viewer.

4.1 Findings

4.1.1 Differences between HTML Viewer and Java Viewer

i) HTML Viewer

The HTML Viewer, in contrast to a Java Viewer, is considered to be relatively thin client, but with reduced GIS functionality. The user is limited to working in a web browser, and only with the data and symbolization that the Map Service author has created. Almost all of the processing occurs on the server, therefore the client has less work to do, but the network has more requests and responses to handle.

How the HTML Viewer works

By making extensive use of JavaScript and DHTML (Dynamic HTML), and Frames, HTML turn a regular web browser into a lightweight GIS client for ArcIMS. All requests are generated using JavaScript, and all responses are parsed using JavaScript. JavaScript is a browser scripting language that works in both Netscape and Internet Explorer (but Netscape does not support as many functions as Internet Explorer, so not everything works the same in Netscape). While some JavaScript is

contained in each of the html pages, the majority of it exists in separate files of JavaScript. This is done in order to better organize all of the functions (sub-routines) into logical groupings, making it easier to find code when the need to customize arises.

ii) Java Viewer

A Java Viewer is an ArcIMS client that was written in the Java language and can be deployed either as stand alone application, or as an applet in a web browser. ArcIMS comes with a web browser based Java Viewer, which can be used with any ArcIMS map Service. The Java Viewers support both Image and Feature Map Services. In fact, multiple MapServices can be combined with local data and viewed in the same Java Viewer. The viewers use a Java 2 Applet for displaying the information and processing requests.

4.1.2 Data Analysis

For this project, the author has made 18 layers under for Bandar Malacca. The layers are :

- i) Place of interest
- ii) Shopping Centre
- iii) Road
- iv) Road 1
- v) Police Station
- vi) Mukim
- vii) School
- viii) Housing Area
- ix) Hotel
- x) Hospital or clinic
- xi) Government
- xii) Education Centre
- xiii) District
- xiv) Canal
- xv) Building

- xvi) Fire Brigade
- xvii) Others
- xviii) Malacca State

There are many kinds of spatial data. For an example, county specific data, census tract data, demographics, tree stand location, hydro acoustical information, constellation mapping, groundwater assessment, pollutant levels, weather station information, ore concentrations, size and distribution of markets, distribution of lung cancer, crime statistics, animal sightings and prediction of fires indices.

There are many methods or tools to analyze data. Leading data analysts and researchers worldwide have recognized S-PLUS as the premier package for data analysis, statistical modeling and data mining. S-PLUS offers the most advanced environment for visualization and cutting - edge statistical methods. S-PLUS can be used with ArcView GIS and S + SpatialStats.

S-PLUS gives the powerful mapping capabilities of ArcView GIS. By using S-PLUS with ArcView GIS, user can discover valuable information hidden in ArcView data, summarize and analyze it effectively, and produce publication-quality graphs. Typical GIS data is spatial in nature, meaning it consists of measurements taken at specific locations or within specific regions. Because information about location may be critical to the analysis, user can use S+SpatialStats to analyze spatial data. With the optional add-on module S+SpatialStats, user can access comprehensive spatial data analysis and modeling tools for geostatistical data, lattice data, and spatial point patterns. By using ArcView GIS, S-PLUS and S+SpatialStats together, user can get the most from GIS data.

4.2 Discussion

4.2.1 Differences Between HTML Viewer and Java Viewer

In general, when compared the HTML Viewer and Java Viewer, the Java Viewer is considered to be most appropriate for intranet deployment because so much of the

processing is done on the client side, and if using a Feature Map Service, the amount of data to be downloaded can be too much for slow, dial up connections. The initial loading of the Java Viewer may also take longer, especially the first time when the applets are first downloaded.

i) Advantages of the HTML Viewer

- Works with both Internet Explorer and Netscape (not all functions are available in Netscape)
- Less client side processing
- Does not require Java 2 plug-in or applet support
- Easily customizable

ii) Disadvantages of the HTML Viewer

- Can only view a single Image Map Service
- No Feature Map Services
- No Edit Notes, Map Notes, Map Tips, layers added by user and many more

iii) Advantages of the Java Viewer

- Supports both Image and Feature Map Services
- Supports feature streaming from a Feature Map Service
- Supports more clientside processing
- User may add layers on top of those from the Map Service. Anything on the user's networked drives can be added.
- Downloads feature vectors and attributes, minimizing the need for multiple server requests
- Can have more than one Map Service in the same viewer
- Some ArcIMS functions can only be utilized with a Java Viewer, such as:
 - Map Tips - hover over a feature, a piece of text appears

- Map Notes – user draws shapes and text on the screen and sends it to the server. Other users can see the notes
- EditNotes- user draws points, lines or polygons on the screen and sends it to the server. The System Administrator can then turn that into a shapefile.

iv) Disadvantages of the Java Viewer

- Map interaction and GIS processing primarily on client machine
- Slower initialization, but more powerful applications possible
- Java2 plug-in required
- Client must download and install the Java Runtime Environment (JRE) if not already present
- Does not run in the Netscape browser

For the viewer, the author chose to use Java Viewer because of the reason that the author had mentioned above.

4.2.2 Website

This system implements the concept of Web-Based GIS to transfer data over the web. This website only focuses on Bandar Malacca's data. Below are the interfaces for this website or system. The system is still under development.

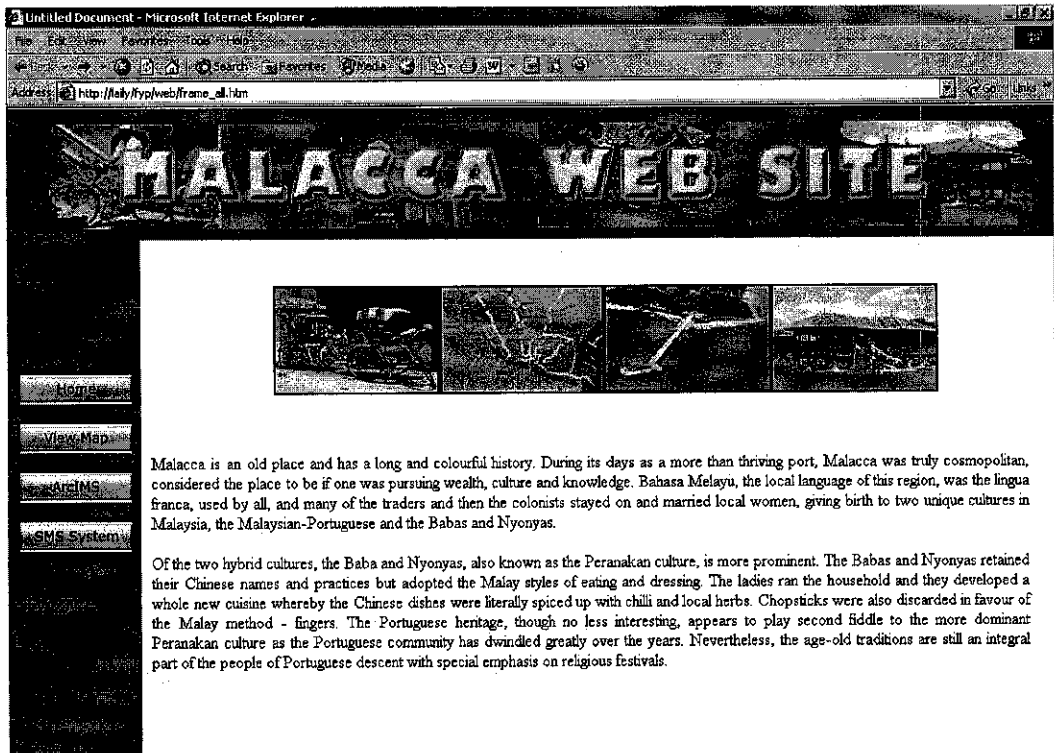


Figure 4.1 : Front page

Front page of the website will show the introduction of Malacca and also about the website. This page will link to View Map, ArcIMS and SMS System. User can only view the View Map's page. Meanwhile, ArcIMS and SMS System's pages are for Administrator.

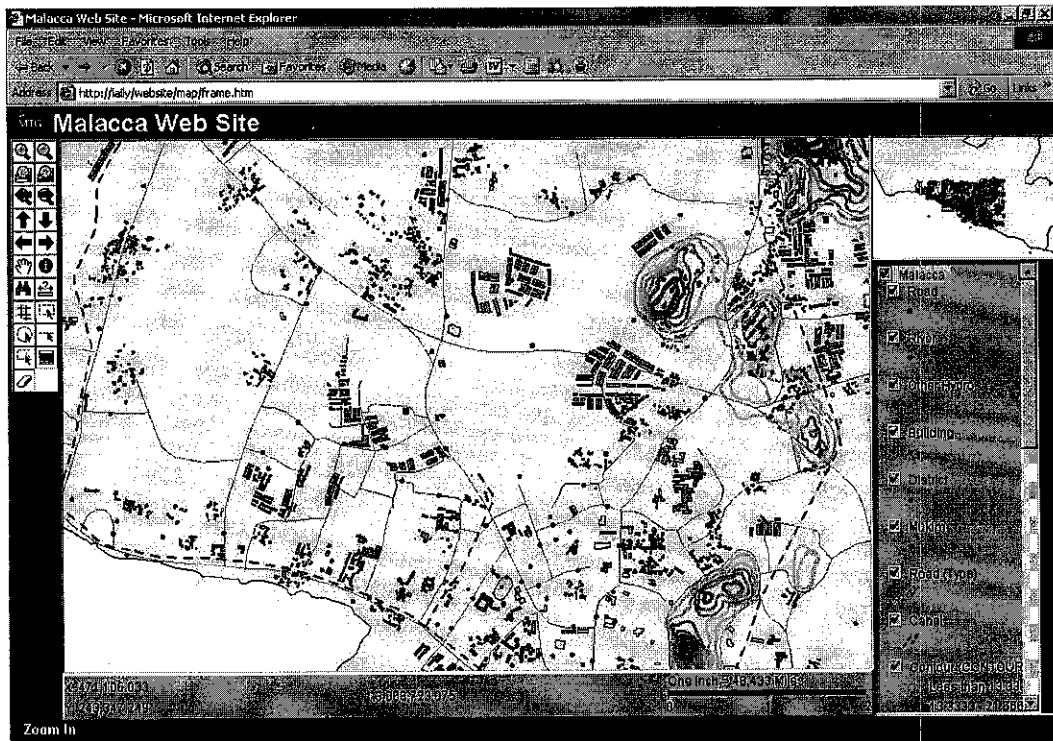


Figure 4.2 : View Map Page

Above is an interface for the user to view Malacca's map from this website. User must click on the View Map's button to reach at this page. User can do many functions on this map. For an example, Zoom In, Zoom Out, Zoom To Full Extent, Zoom To Active Layer, Previous Extent, Next Extent, Pan To North, Pan To South, Pan To West, Pan To East, Pan, Identify, Find, Measure, Buffer, Select By Rectangle, Select By Circle, Select By Line and Select By Polygon.

The zoom and pan tools allow user to change the map extent. Zoom in or out by clicking an area of the map or by clicking and dragging a box around it. Zoom to the full extent of the map, the extent of the active layer, the last extent, or the next extent by clicking the appropriate tool on the toolbar. Meanwhile, pan the map to see features beyond the current extent or to recenter the map by clicking on the Pan, Pan to North, Pan to South, Pan to East and Pan to West tools.

Besides, Identify tool is used to see information about individual features of the active layer. If features are close together, clicking the map will return attribute information for more than one feature. If the Identify Results dialog box lists more than one feature in the left panel, click each feature to see attribute information in the right panel. To avoid accidentally clicking more than one feature, zoom in before using the Identify Tool. Below is an example of using Identify tool.

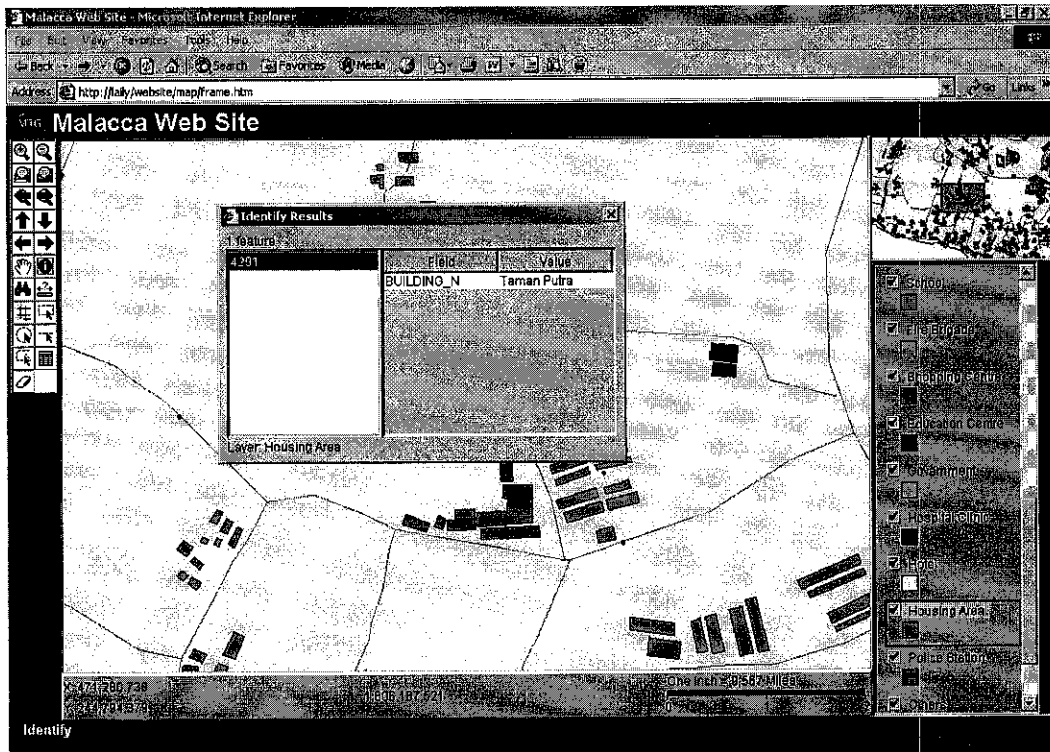


Figure 4.3 : Identify Tool

The Find tool locates features with an attribute value matching a string that the user type. User can enter all or part of a word to search for. The Find dialog box displays the list of matching features in the right panel. User can see the complete attribute value matching the string that they type. User can also see the field to which the attribute value belongs. Below is an example of finding features.

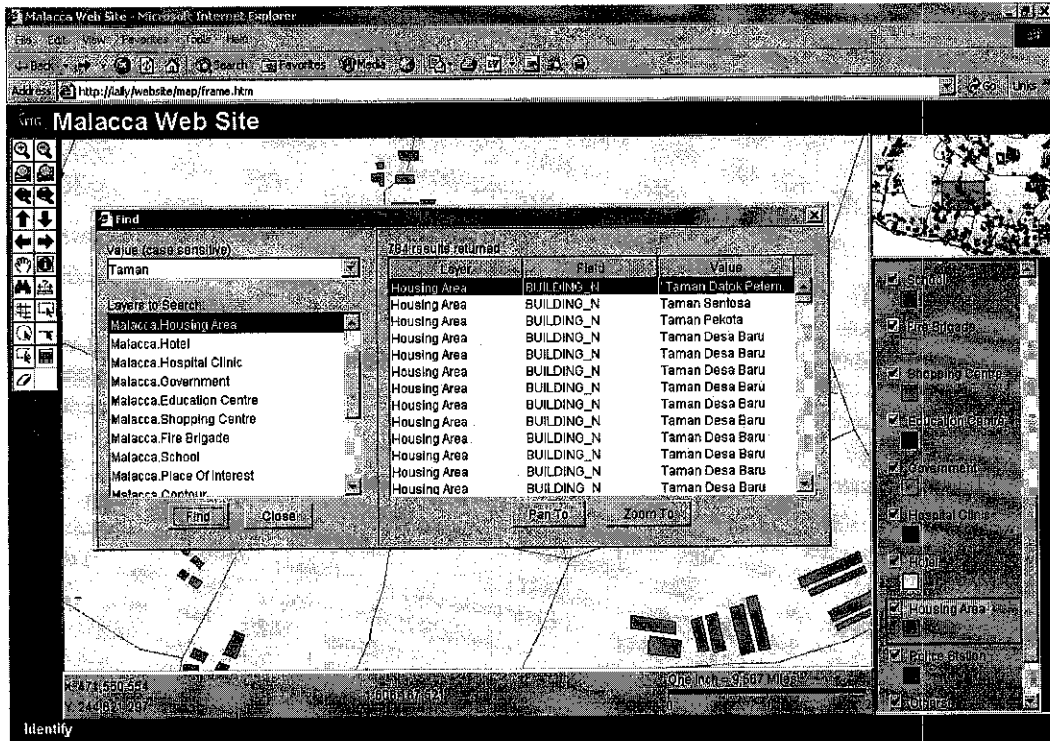


Figure 4.4 : Find Tool

User also can use the Measure tool to measure distances on the map. To measure the distance from one point to another, click the starting point, then holding the mouse button down, drag the mouse pointer to the endpoint. The length of the line segment is displayed in the upper left corner of the map display area. User can also measure as many distances as they like. The total length of all of the line segments are also shown in the upper left corner. Below is an example of Measure tool.

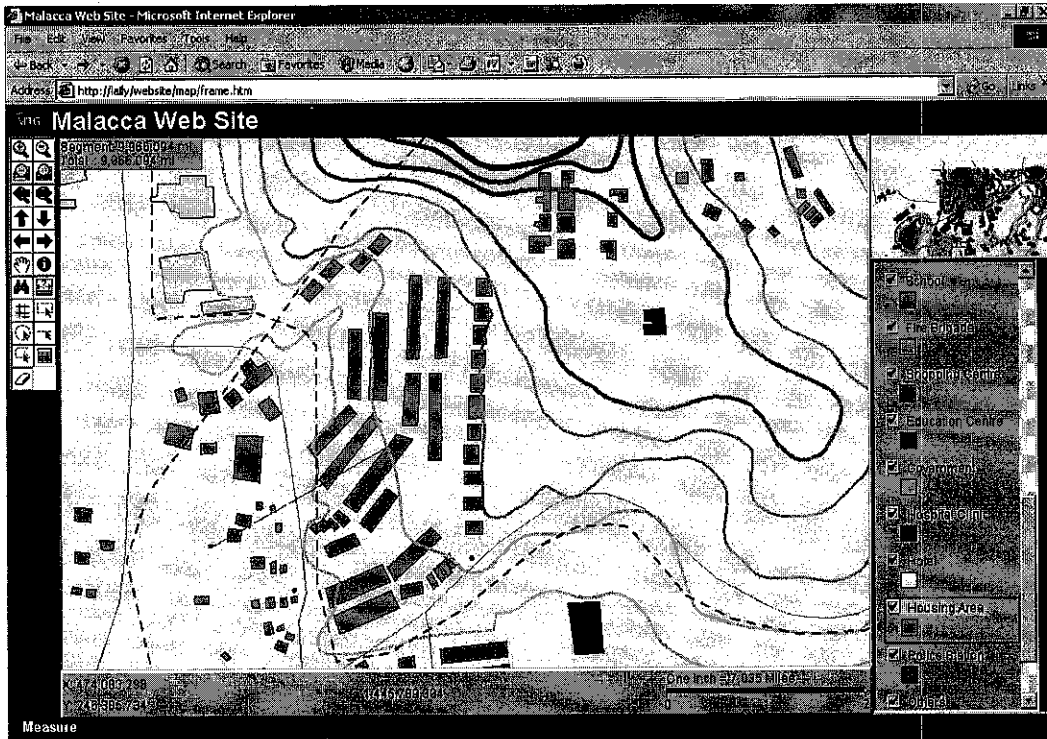


Figure 4.5 : Measure Tool

Besides, ArcIMS's button is for administrator. This button will link to the ArcIMS login. Administrator must enter User Name and Password to enter to this page. The administrator has capabilities to manage the system, add, delete, edit or update data and also to make any changes for the system. Below is an interface of the login page.

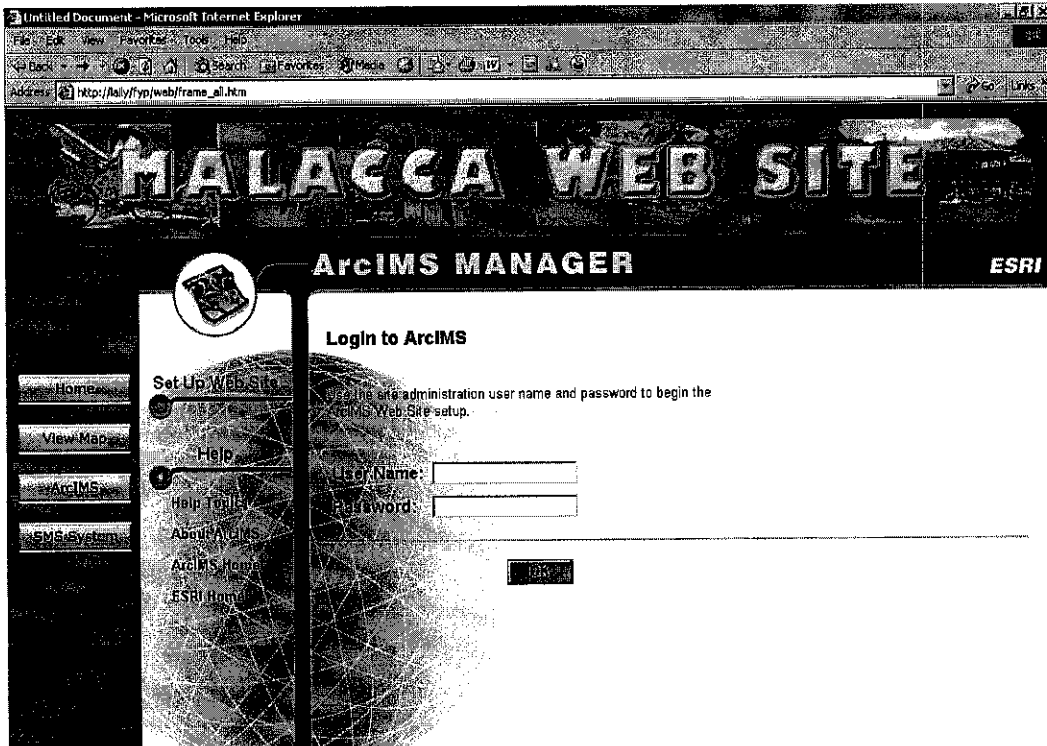


Figure 4.6 : ArcIMS Page

Meanwhile, SMS System page is linked to the SMS System. Administrator must enter User Name and Password to login to the system. Below is an interface for this page.



Figure 4.7 : SMS System Page - Login Page



Figure 4.8 : SMS System Page

CHAPTER 5

CONCLUSION AND RECOMMENDATION

In this paper, Web based GIS for Malacca is implemented so that tourist and people can share GIS data. This system is relevant to the objective of the project. After finishing developing the system, it hopes that tourist can easily find their desire location in a shortest time period. Besides, this system can provide an accurate information and location for the tourist. The development of GIS has relied on innovations made in many different disciplines. GIS integrates spatial and other kinds of information within a single system. It offers a consistent framework for analyzing geographical data. By putting maps and other kinds of spatial information into digital form, GIS allows us to manipulate and display geographical knowledge in new and exciting ways. GIS make connections between activities based on geographic proximity. GIS also allows access to administrative records for an example property ownership, tax files, utility cables and pipes via their geographical positions. The enhancement features in ArcIMS makes mapping data and information easier. Hence the development of user-friendliness system is easily to build. With the advance of Web technology, Web-based GIS has already become one of the focuses of GIS research. Many Web-based GIS systems have been built around the world. Even some commercial software packages are now available which make the construction of Web-based GIS systems easier than ever. Web-based GIS also can integrate with mobile application for an example like handphone, GPS and many more.

As for a recommendation, it hopes that the system can be integrated with other technology for an example like Global Positioning System (GPS) and remote sensing. Other than that the system also can be integrated with the external databases such as MySQL, Oracle, SQL Server and many more.

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