Implementation of Web based GIS Application for Mapping of Health Facilities, Services and Providers in Malaysia

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Methods: The system is web-based mapping and navigation can be used with Internet such as Internet Explorer and Mozilla Firefox. The development of web mapping system was programmed by using Arc GIS Server. Tools and GIS software functions will be simplified to allow the search and analysis process can be done more easily.

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GJCST-E Classification : J.3

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Strictly as per the compliance and regulations of:

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Results: There are four modules in the system created. First module is view for display list of health facilities in the system. Second module is search to obtain information on health facilities, services, providers and specialty. Third module is analysis for gathered an area of geographic information, get ratios facilities, services, and providers of services to the population, analysis of the buffer zone (buffer) to find coverage of a health facility for a certain distance and other geo statistical analysis. Last module is tools for issue the results of the analysis in the form of tables, graphs and maps that can be stored or printed. The system is controlled by the administrator where users need to request to use this application.

Discussions: Web mapping can be expanding by using smart phones and tablet that supports Android, iOS and Windows phone. This system can also know the distribution of the disease in real time by appropriate user can update through online. Web mapping application enables user to use the GIS database has information facilities, services and service providers without having to have a deep knowledge in the field of GIS or using GIS software.

Conclusions: This system assists stakeholders in the Ministry of Health in planning and developing facilities and services in Malaysia. It also to reducing the use of human resources especially in monitoring and providing health services information and facilities in Malaysia.

Keywords: web mapping, GIS, spatial.

I. Introduction

Interactive mapping or Internet GIS has developed rapidly over the past few years resulting in the migration of some GIS functionality.[1] An interface system should be established to facilitate the users in terms of search, analysis and printout. This system enables users to use applications without the use of specialized GIS software. Users only need to use internet browsing application such as Internet Explorer, Mozilla Firefox to use the system.

The objective of this study is to design, develop, create, deploy, test and deliver, together with documentation, help manual and training for web based GIS application of health facilities and services under Ministry of Health, Malaysia.

Arc GIS Server is a comprehensive platform for delivering enterprise GIS applications that are centrally managed and support multiple users. Arc GIS Server provides the framework to build and deploy centralized GIS applications and services to meet a variety of needs using a variety of clients. Organizations use Arc GIS Server to distribute maps and GIS capabilities via Web mapping applications and services to improve internal workflows, communicate vital issues and engage stakeholders. The intuitive web map strengthen the business and resource decisions with real-time location intelligence, geographically enable IT investments and a centrally managed geo data, provides better data security and integrity for information assets.

II. Methodology

Designed and development of interactive web portal application for healthcare facilities in Malaysia. The application is based on Arc GIS Server with Arc GIS Viewer for Flex.

An Arc GIS Server is a server that serves GIS Services such as map service, geo data service and image service. An Arc GIS Server consists of data server, GIS server and web server. Arc GIS Server software are required for building, managing and displaying GIS data on the Web to support desktop, mobile and web-based mapping applications. Server and Arc GIS Server software was purchased with funding from the Centre for Health Informatics. Institute of Public Health is responsible for developing the interface system and when complete will be submitted to the developed for the purpose of updating and maintenance. [3]

Arc GIS Viewer for Flex provides a smart, intuitive framework for looking at and interacting with maps. It is a configurable web application that allows user to easily build user own custom mapping application in just a few minutes, with no programming

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required. The locations of the health facilities are visualised using shape files data. Moreover, it is possible to search objects, to print out maps and to get mouse-click information for specific objects. [4]

III. Results

This study identified that web based mapping system consist four modules such as view, search, analysis and tools. The user must enter the login and password to access the system for security purposes (Figure 1).

First module is viewing list of health facilities in the system. User enables navigate to the system for gathered information from specific health facilities. Spatial data are divided into two type's categories which are base map and list of health facilities (Figure 2). Features such as info, zoom in, zoom out, pan, full view, measure, hyperlinks will be established to facilitate the user browsing system.

Second module is search can be performed to obtain information on health facilities, services, providers and specialty. There are two categories of search which are general search and specific search. First categories divided by two options which is search layer by select features (Figure 3) and typing search by graphics that showed in the menu. (Figure 4) Second categories are user can search health facilities, health providers, services and specialty in specific area until sub district boundary. (Figure 5)

Third module users can create a variety of spatial analysis as follows obtain an area of geographic information, get ratios facilities, services, and providers of services to the population, Analysis of the buffer zone (buffer) to find coverage of a health facility for a certain distance and other geo statistical analysis. Network analysis (Network Analysis) is used to determine the distance as distance from a facility to other facilities and the distance between settlements with selected health facilities. (Figure 6) User can find the nearest health facility to a selected area. Users need to select the appropriate distance and related health facilities next to mark on the map the selected area. Applications will list all health facilities related close to the selected area. (Figure 7)

Fourth module is the tools where user can issue the results of the analysis in the form of tables, graphs and maps that can be stored or printed. (Figure 8) In addition, this system also provides the facility to duplicate (backup) data.

*Figure 1 :* Login to the system using by enter username and password

*Figure 2 :* Distribution of health facilities by user selection
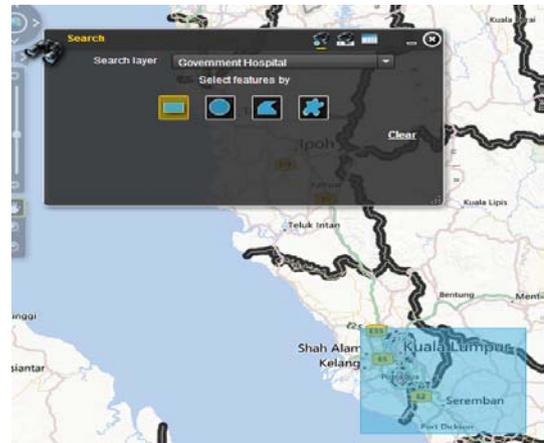
Figure 3 : Select features by draw rectangle

Figure 4 : Search by typing name of health facilities

*Figure 5 :* Specific search by geographical area

Figure 6 : Distance calculation to each health facilities

Figure 7 : Health facilities within distance buffer from selected point

Figure 8 : Printing result from system

IV. Discussion

Most effective ways to update data to be more accurate and latest are service provider can perform web editing through application. The web editing capabilities in application for Server allow user to support collaboration and editing workflows within user organization as well as volunteer geographic information (VGI) data collection and editing by the general public. [5]

The application can incorporate real time data into user GIS applications. It can connect to common sensors and feeds, such as in-vehicle GPS devices, mobile devices, and social media providers and includes an exceptional set of real time filters and analytical capabilities. User gains the unique capability to efficiently detect and respond to the most important events, locations, and thresholds for user operations.

Application can connect to any sensor includes connectors for common sensors including in-vehicle GPS devices, mobile devices, and social media providers. Additional connectors can be found online, enabling user to handle the types of sensors user use. User can accommodate multiple streams of data flowing continuously through filters and processing steps, allowing user to detect and focus on the most important events, locations, and thresholds for user operations without interruption. The application can makes it possible to track all of most valuable assets on a map, whether they are dynamic assets that are changing location, such as vehicles, aircraft or vessels, or stationary assets built into user physical networks and infrastructure. When locations change or critical thresholds are met, application can automatically and simultaneously send alerts to key personnel, update the map, and append the database, as well as interoperate with other enterprise systems. [6]

Application can enhancement to latest technologies by use and display through smart phone and tablets. This function also has ability to embed maps and tasks into related applications.

Apps for Smart phones and Tablets use mobile capabilities in user existing enterprise workflows to extend the reach of GIS to a wider audience. Mapping applications and developer-focused can take advantage to improve the efficiency of field operations and help user make timely and more informed business decisions. These applications make it faster and easier for field and office staff to collaborate and get real time information. [5]

Future application extends the reach of user GIS from the office to the field. Navigate maps, collect and report data, and perform GIS analysis using the free downloadable application from Google Play, the Apple App Store, Amazon App store, and Windows Phone Marketplace. The app includes a developer-focused Runtime SDK that user can leverage to build user own
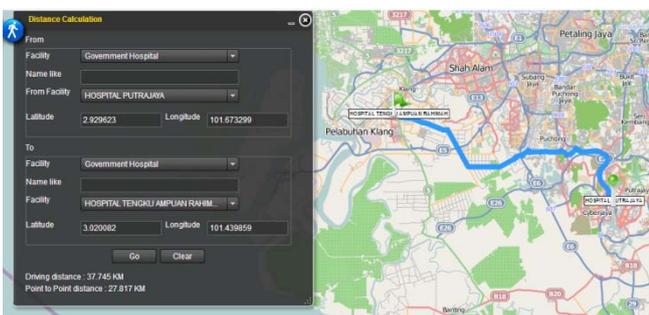
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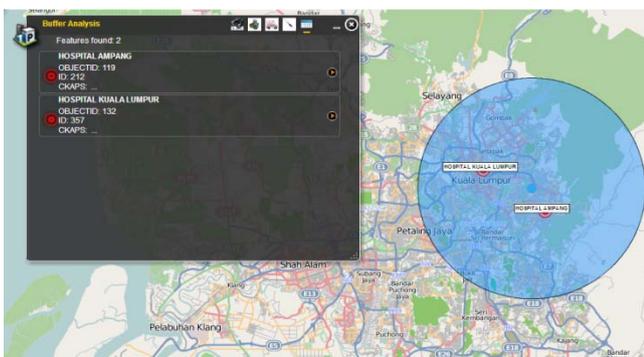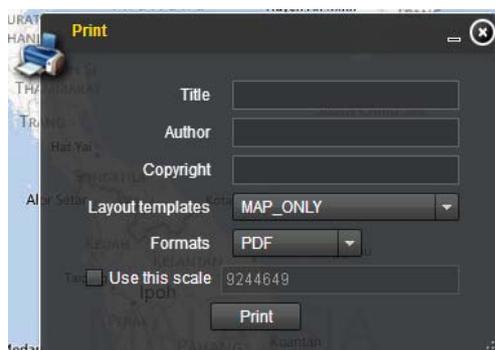
custom mobile applications. The Arc GIS App is a part of the Arc GIS platform and is a great way to discover and share content by browsing map galleries from Arc GIS Online or leverage services from user existing enterprise GIS, collect, edit, and update features and attributes, use tools to search, identify, measure, and query, develop a custom application or brand user own application specific to user business needs. [6]

V. Conclusion

Web mapping application enables user to use the GIS database has information facilities, services and service providers without having to have a deep knowledge in the field of GIS or using GIS software. This system assists stakeholders in the Ministry of Health in planning and developing facilities and services in Malaysia. It also to reducing the use of human resources especially in monitoring and providing health services information and facilities in Malaysia.

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