

Designing a GIS Web Base for Locating Health Care Locations in KSA using Google Earth

Dr.Samir Mahmoud Adam Abdoalla

Assistant Professor in Computer Science Department, Applied Medical Sciences College, Taif University, Kingdom of Saudi Arabia (KSA)

Abstract

This study focuses on the development of a web-based GIS for public healthcare system using GIS web base application choosing Google Earth as a sample . The development of this system is motivated to provide opportunities for the healthcare workers to gain access to vital information that can aid him/her in the location of viable hospitals for the patients to fully enjoy available enhanced healthcare services. Currently, three major problems still exist in the healthcare geographic applications. This relate to health mapping methods, reusability of health applications, and interoperability issues. To handle these problems, we design a Web based GIS for Public healthcare system to support health data sharing and representation. The developed model makes it possible to locate the nearest hospitals as well as the services they rendered. With Google Earth, you'll be able to see math concepts in a different light. They're worth exploring and understanding fully. In Google Earth you'll be able to interact with the concepts and see how they're evident in real life. These lessons are sure to be more interesting than just another page in a math text.

Keywords: Web-based GIS, Public healthcare, Decision Support System. Google Earth ,ArcGS10.3,GPS

1- Introduction

Google Earth is a virtual globe program, allowing viewers to visualize data on top of displayed satellite images of the Earth's surface. Launched in 2005 and released to the public in 2006, Google Earth fast became a household name hailed as a revolution for humanitarian development, much as Geographic Information Systems (GIS) were several decades ago. According to Map Action, "There seem at present to be two distinct groups of humanitarian practitioners: those who are already, albeit tentatively, exploiting Google Earth and related geospatial methods in their work,.As a geospatial program installed on the computer, Google Earth users have access to detailed imagery constantly downloaded, as different areas are panned or zoomed. It is possible to use Google Earth without an internet connection, but functionality is limited to low resolution satellite imagery, imagery cached on the computer from recent use, and locally saved KML (Key hold Markup Language) files. Google started the 'Google Earth Outreach' program in 2007 to help US and Europe-based nonprofit organizations use Google Earth and Maps in their work. This program provides tutorials and case studies online, granting Google Earth Pro licenses to qualifying organizations interested in using Google Earth. Health planning on a micro scale [2].



Figure 1 KSA in Google Earth Map

2-Google Earth Features

Base Imagery Google Earth compiles base layer imagery from satellite and aerial photography data sources. As sources range from one to three years old, there is some variation in quality of images and some areas may appear blurry, discolored, or covered in clouds. Generally, there is high-resolution imagery for populated areas, for example cities in the USA, and less quality images for less populated regions, for example the middle of the Egyptian Desert. Some remote areas, however, have high-level detail, while some urban centers do not, depending on the availability of images. Zooming in and out increases or decreases the level of feature details on a landscape. Where data are out of date, some feature details, including villages and small roads, may be missing or spatially inaccurate.

2.1-Google Earth Layers

Google Earth uses a Layers feature to superimpose details of interest, for example Roads, Borders, Populated Places, Terrain, etc., onto base imagery. Google Earth also provides layer options for such features as current Weather, Conditions and Forecasts, Traffic patterns, and Places of Interest. Layers features can be turned on and off in the Layers panel (lower left menu). The Terrain Layers feature adds elevation data to Google Earth imagery, giving a 3D impression of the landscape. Elevation exaggeration can be altered in Tools > Options > 3D View.

Google Earth bases their 3D imagery on digital elevation model (DEM) data collected by NASA's Shuttle Radar Topography Mission.

2.2-Some Google Earth User Features



There are four types of basic user feature in Google Earth: (1) Placemarks, (2) Paths, (3) Polygons, and (4) Image Overlays (icons found in the panel along the top of the image screen). A Placemark is a single point with an identifying label. Clicking the icon provides users with a movable yellow pushpin to place on their identified location, and a dialogue box to enter Name and Description. Personalization options allow users to alter Altitude, Coordinates, Style, and Color. Custom icons can be selected to replace the pushpin, and adapted for Size, Color, and Transparency. The only aspect that cannot be personalized is the position of the text relative to the Place mark.



A Path is a line made up of several points, generally used for roads, rivers, trails, or boundaries. It is drawn and edited similar to a Placemark, with option to change Color, Width, and Transparency. No options for custom line patterns exist. Mistakes are undone by right clicking on the Path. With Path, width remains the same regardless of the level of zoom. If confusing to view on screen, another option exists by using Regions (see §VI: Regions and Levels of Detail), but it is not as user friendly.

2.3-Some Free GIS web-based GIS applications

Map sites	Pros	Cons
Windows Live http://maps.live.com	Similar to Flash Earth. 3D buildings available in some urban areas; good detail in 'birds eye' view.	Mass of non-geographical information.
Magic www.magic.gov.uk	Powerful GIS application allowing interrogation of a variety of georeferenced environmental data.	Takes time to familiarise with the user interface.
Quikmaps www.quikmaps.com	Ability to draw on and label a Google map. Student friendly and suitable for example, in fieldwork investigations. Contours visible.	Need to sign in and create an account for maximum functionality.
Google Earth www.earth.google.com	Hugely powerful; very versatile.	User friendly but for advanced use some training may be necessary. Need to download and install across a network.
Flash Earth www.flashearh.com	As for Google Earth but 'flash' based means that there is no need to install.	No need to install but eats up bandwidth across a network.

Table 1 Some Free GIS web-based GIS applications

3-Esri ArcGIS web base system Architecture

Server GIS: ArcGIS for Server provides technology for publishing GIS services that can be consumed by ArcGIS for Desktop, mobile GIS, and standard web browsers. ArcGIS for Server has grown over the last few releases to include imagery, SDE geodatabase access, and distributed geodatabase management within a common set of ArcGIS executables.

GIS Data: Data management solutions are provided for file data sources, geodatabase, imagery, and pre-processed map cache. Files include GIS shapefile and file geodatabase formats. SDE geodatabase is used for multi-user GIS data maintenance operations. Imagery is fully integrated with ArcGIS since the ArcGIS 10 release. A map cache is a file share that delivers preprocessed map tiles as high-performance basemaps for map display.

Web Browser Clients: A variety of web applications and browser clients extend ArcGIS access throughout the web community. ArcGIS offers APIs for web application development on JavaScript, Adobe Flex, Microsoft Silverlight, and WPF platforms. ArcGIS for Server delivers mapping services with additional capabilities for web applications using SOAP and Open Geospatial Consortium (OGC) web service APIs.



Figure 2- ArcGIS 10.3 web base system Architecture from 18

The application layer forms the centre of the architecture and oversees the relationship between other components in the system, as well as determining how the system functions. It extracts the data requested by a client from the data layer and then processes it. This is then passed to the presentation layer to display to the client. The application layer is also responsible for performing modifications to the database layer that are requested by the client. The presentation layer displays the combined output of the application layer and the map generation layer to the client. The Internet and HTML are used to transport this information and allow the communication between these components. In addition to the display of information, change requests are also posted to the application layer through the presentation layer.

4-Google Earth satellite base imagery

Many places are hard to recognize from above as they are missing much of the 'human geography' of the landscape (MapAction, 2008). Traditional dark cartographic symbols like those in Figure 4 are difficult to distinguish against dark ground colors. One solution is to create more traditional maps by having a white Polygon over area of interest, with pertinent features and symbols drawn on the Polygon .

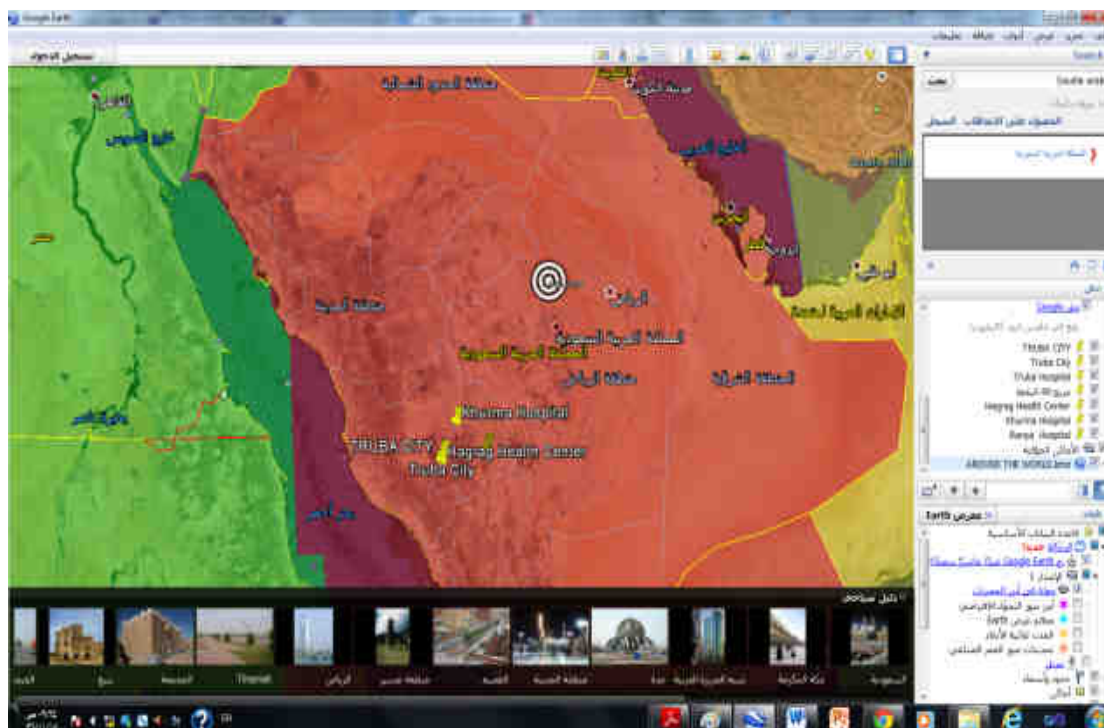


Figure 3 All Taif Health Area

4.1-Using Layers in Google Earth

A plain satellite image is just that until you add information to visualize the data you want to explain. Layers are used to represent information on a map. Imagine layers as a transparent sheet with information that goes over a plain map. For example, you can add a “transparent sheet” with blue lines over a plain map to represent rivers. You can put another transparent sheet over that with polygons that represent flood zones over that sheet. Now the plain map shows information on rivers and flood zones. If you want to just display the flood zones, you can remove the river sheet. This concept works for understanding layers in Google Earth. In the bottom left-hand corner, you will find layer options provided by Google Earth. To make a layer visible, click on the box next to the layer name and the layer will appear on the map.

5-Health Care Planning

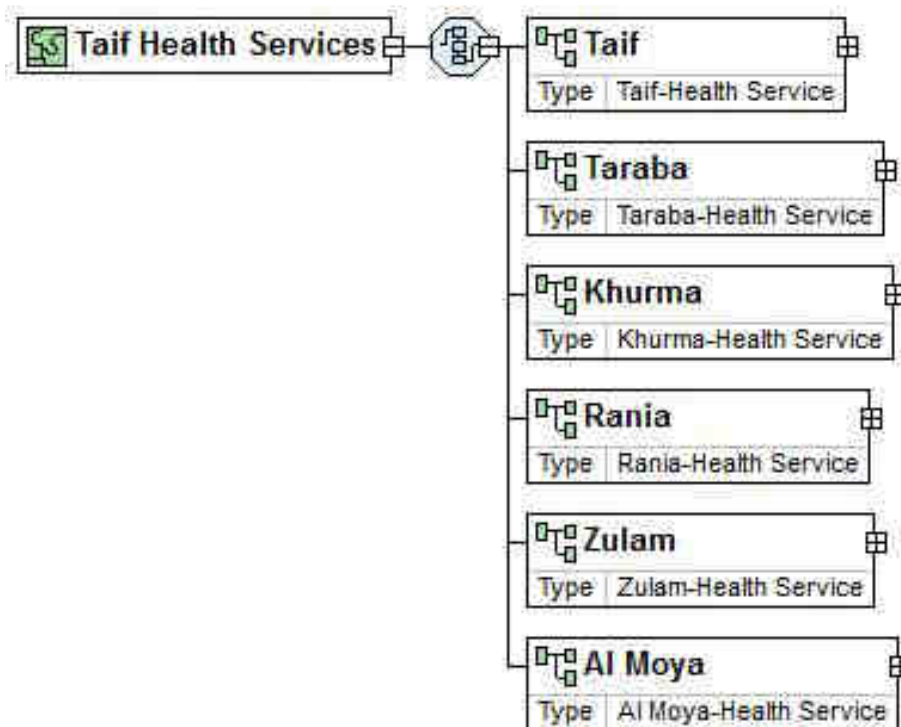
GIS spatial planning support tools have an important advantage; changing the valuation criteria to visually illustrate and depict the implications of different spatial decisions and alternatives is convenient. The capabilities needed for decision making readily available in a single system make GIS a great tool for integrating in planning processes. The first part of this paper explain the issues that affect a local health care planning and monitoring of catchment area and facilities management. Each one of these issues is covered using several GIS functions including network analysis and spatial data analysis. Health Care Planning in Saudi Arabia Health care planning system in Saudi Arabia has different agencies that play important roles in providing health care to residents. These agencies are The Ministry of Health, The National Guard, The Ministry of Defence and Aviation, and The Ministry of Interior [3]. In addition to these agencies there are specialist hospitals in Saudi Arabia that provide. Health care to specialist health cases. These agencies provide health care services on the basis of exclusive free health care to all citizens. In addition, the private sector in Saudi Arabia plays an increasingly significant role in the Kingdom and coordinates with the referral network and the regulatory requirements of health sector as a whole [4]. The Ministry of health in Saudi Arabia has seen that the primary objective of both the public and private health sector is to improve the health conditions of all citizens through the provision of comprehensive preventive and curative health services throughout the Kingdom, with particular emphasis on equitable and efficient primary health care (ibid).



Figure 4 Location of Taif area health Center In Taif city from <http://www.moh.gov.sa/Sectors/Directorates/Pages/default.aspx>

5.1-Locating Health Services

Health care analysts have long been involved with questions of location—deciding where to locate new service resources, which existing facilities to close, and how best to improve service locations. Location-allocation models, and related optimization methods, provide tools for addressing these types of questions (6). Relying on spatial data commonly available in GIS, location-allocation models are increasingly being implemented in a GIS environment.



5.2-Locating Hospitals from Google Earth in KSA Taif Area

The Turbah Health Care services Centres in Taif City and neighbourhood centers , this issue is covered using

two main GIS techniques which are network analysis and overlay analysis. Network analysis is one of the ArcGIS modules that facilitates the modeling of spatial networks and can be used to determine the efficient paths and travel sequences. This module is used in the presented study for determining and calculating drive time to hospitals at Taif city. In general, a network is a system of interconnected linear features through which resources are transported or communication is achieved. The network data model is an abstract representation of the components and characteristics of real world network systems [12].



Figure 5 Location of Truba Main Hospital Google earth map

6-Spatial Decision Support Systems

Efforts are under way to develop spatial decision support systems (SDSS) that integrate GIS with an array of analytic methods to support health care planning and assessment. SDSS combine a geographic database, a system for database management and querying, a user interface, and a set of analytical tools like location-allocation and spatial interaction models (57). Designed for addressing “ill-structured” problems, the systems allow decision-makers to pose questions, explore alternatives, and identify potential solutions in an interactive, computer based environment

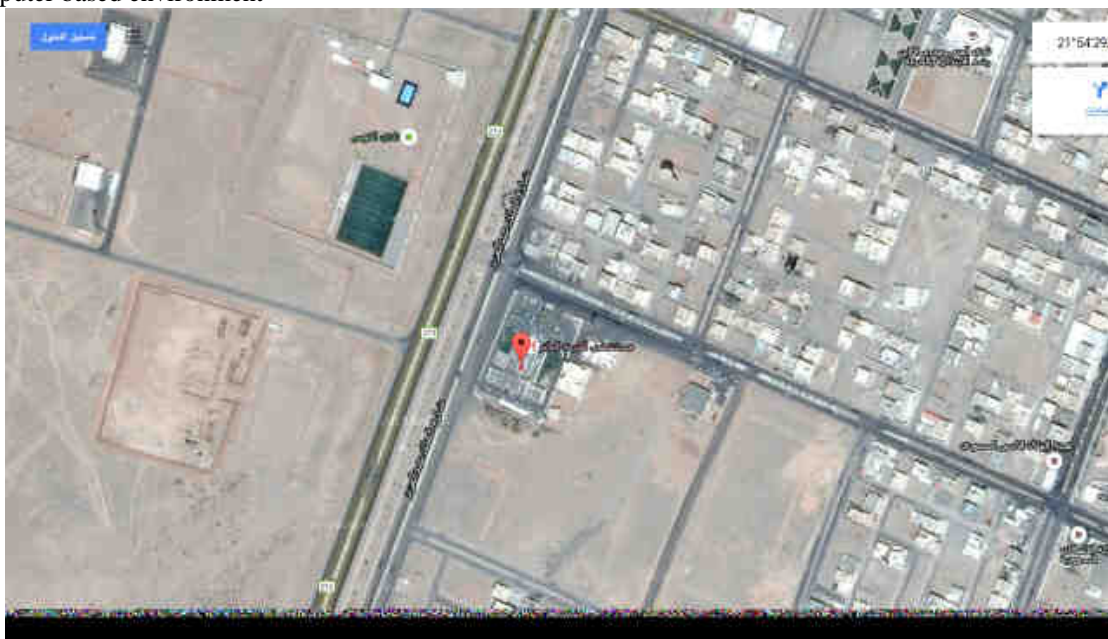


Figure 6 Khurma Main Hospital Google earth map



Figure 7 Rania Main Hospital Google earth map

7. Results

If we compare the web base applications of GIS , Esri Application ArcGIS 10.3 have a web base geodatabase availability , but it's too expensive for single and small administrations users , For The Ministry of Health care in KSA They can use the products of ArcGIS 10.3 Web Server to links the ministry health care locations . This work shows how Geographical Information Systems (GIS) can be used to support health planners and demands on a micro-scale and explores the possibilities of using GIS for health care services in hospitals at Saudi Arabia subareas. GIS has several useful functions and tools that can be used in health planning field. The present study has been covered these issues by using GIS for Makkah Area especially for Taif health centre and neighborhoods cities. GIS is used to analyses the centre catchment as well as studying the spatial data analysis of some diseases such as of blood cancer and blood sugar or fitness patients. The presented study has calculated travel time for each arc based on the average driving speed along each arc and based on the arc length. The resulted cost is saved as an arc attribute and used during the process of creating drive-time service area of the selected hospitals and health care centers .Google Earth allow a free gis maps which available and shows real location specially when using GPS (Global Positioning System).The mistry of health in KSA use the Google earth maps for locating all their hospitals and health center , its available in the web site of the ministry .for applying active Google Earth applications should be made to allow active and real locations , which helps for dectian support managers of the health care.

8.-Discussion

The main goal of GIS analytical technique that is used within the hospital service area issue is called overlay analysis. It is observed that the resulting of this application are very useful for health planners and demands on a micro-scale and explore the possibilities of using GIS for health care services in hospitals at Saudi Arabia subareas; because they evaluate the level of service provision at the selected area. Another advantage is found that the existing health supply of Saudi Arabia Subareas comparison was done for health care activities and the relation between populations and geographical areas, and importation criteria was taken to help reaching to neighborhood health care services. Finally, the same technique can be applied at the other health centers of other Saudi Arabia subareas, and by doing so health care planning and demanding would be more effective in Taif City and other neighborhoods cities named.

9-Conclusin and Future Directions

Use of ArcGIS 10.3 web server can face the increase in health care research has using of web base GIS which provide new ways to investigate health care needs for small geographical areas, better measures of geographical access to health services, and new approaches to analyzing and planning services locations. Google earth has many features available Nevertheless, adoption of GIS has been very uneven. Research areas that can benefit from GIS, such as research on geographic variations in health care utilization, have not made full use of GIS

capabilities. Furthermore, some researchers continue to view GIS as primarily a mapping tool. For future work, we intended to test our GIS on more cities in KSA. Also, we think that such output of creating and implementing our GIS models are very relevant to help a local health planner in their health care decision making output. Health care planning is a challenging field that depends on spatial data such as location and characteristics of health centre demand. Today, health planners have several tasks to cover to assure that health services are provided at the best location. Epidemiology and accessibilities are two important issues in local health planning. The main features of the proposed a GIS technique could be summarized as follows.(a) The WEB Base GIS technique has been used effectively within the hospital service area issue is called overlay analysis using Google Earth Technology. (b) The results of the GIS technique were very useful for health planners and demands on a micro-scale and explore the possibilities of using GIS for health care services in hospitals at Saudi Arabia subareas. Because they evaluate the level of service provision at the selected area.(c) It is found that the existing health supply of Saudi Arabia Subareas comparison was done for health care activities and the relation between populations and geographical areas, transportation criteria was taken to help reaching to neighborhood health care services.(d) The same technique can be applied at the other health centers of other Saudi Arabia subareas, and by doing so health care planning and demanding would be more effective in Taif City and other neighborhoods cities named.GIS has been used to analyses the centre catchment as well as studying the spatial data analysis of some popular diseases such as of blood cancer and blood sugar or fitness patients in Taif City and other neighborhoods cities.

10. Reference

1. Landais P. End-Stage Renal Disease in France: Epidemiology of care demands. Supply of care and prevention.Presse Med. 2002;31:167–85. [PubMed].
2. Landais P, Simonet A, Guillon D, Jacquelinet C, Ben Saïd M, Mugnier C, Simonet M. SIMS@REIN: a multi-source information system for end-stage renal disease. CR Biol. 2002;325:515–528. [PubMed].
3. Ben Said M, Simonet A, Guillon D, Jacquelinet C, Gaspoz F, Dufour E, Mugnier C, Jais JP, Simonet M, Landais P. A dynamic Web application within an n-tier architecture: a Multi-Source Information System for end-stage renal disease. Stud Health Technol Inform. 2003;95:95–100. [PubMed].
4. Croner CM. Public Health GIS and the Internet. Annu Rev Public Health. 2003;24:57–82. [PubMed].
5. Richards TB, et al. Geographic information systems and public health: mapping the future. Public Health Rep.1999;114:359–60. [PMC free article] [PubMed]
6. Needleman S, Wunsch C. A general Method Applicable to the Search for Similarities in the Amino Acid Sequences of Proteins. J Mol Biol. 1970;48:443–453. [PubMed].
7. Mugnier C, Ben Said M, Le Mignot L, Jais J, Le Bihan C, Landais P. Avoiding doubles in distributed nominative medical databases: optimization of the Needleman and Wunsch algorithm. MEDINFO.2004;2004(CD):1763. [PubMed].
- 8 Jones K. An Introduction to Data Warehousing: What Are the Implications for the Network? Int J Network Mgmt. 1998;8:42–56.
9. Bapna, S & Gangopadhyay, A (2005). ‘A Web-Based GIS for Analyzing Commercial Motor Vehicle Crashes’ Information Resources Management Journal Hershey: Jul Sep 2005. Vol.18, Iss. 3; pg. 1, 12 pgs. Accessed 06/07/06. <http://proquest.umi.com/pqdlink?Ver=1&Exp=09-18>.
10. Cromley and McLafferty, (2002) Ellen K. Cromley and Sara L. McLafferty "*GIS and Public Health*" The Guilford Press ISBN: 1-57230-707-2 .
11. Colas, N, Houston, B & Warnecke, L 2000, „Internet-Based GIS for Local Government: A Non-technical Guide to Planning and Implementing an Online Geographic Information System“, Cayuga County Planning Department, New York. Accessed6/07/06.
12. World Health Organization, (2007).The world health report: A safer future: global public health security in the 21st cent .14-F. B. Abdullahi1, M.M Lawal2 & J.O Agushaka3 ,DESIGN AND IMPLEMENTATION OF A WEB-BASED GIS FOR PUBLIC HEALTHCARE, IJRRAS 4 (4) ٢٠٠٩ September 2010 Abdullahi & al. Healthcare Decision Support System

AUTHOR'S PROFILE



Dr.Samir M. Adam: Was born in El Fashir ,West Dar Four Sudan on November 21, 1959.Graduated from U of G Faculty of Science and Technology in 1986 with a B.Sc.degree in Electronics, Instrumentation and applied physics M.SC Graduated from U of K faculty of Mathematical Science Department of Computer in Computer Science 1996 ,.Ph.D in Computer Science University of Khartoum 2012. IN GIS ,Working As Assistant Professor of computer science at the Faculty of applied Medicine in Taif University, Kingdom of Saudi Arabia.