Medical Services Management GIS Web Based Generation of Khartoum State

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Abstract: *A GIS plays a critical role to make a decision on where and when to improving the quality of care and availability of services, and protecting patient confidentiality while satisfying needs of the research community on data accessibilityArcGIS Enterprise is a platform of ArcGIS. It provides Web GIS that runs behind firewall, in your infrastructure, and fit together with your enterprise systems and policies.With a suite of user-friendly apps included as part of ArcGIS Enterprise, you and any member of your organization can tap into the power of spatial analytics.Publish your GIS resources, such as a maps, tools, or geodatabases, and make them available to a wider audience as GIS web services on ArcGIS Server You can even configure your own apps from scratch and deploy them on any device.*

Keywords: Arc GIS, Web map, Server, Client, Medical services

1. Introduction

Health data maps and Geographic Information Systems (GIS) are significant resources for health planning and health services delivery, particularly at the local level. The ability to visualize the spatial distribution of health status determinants and indicators can be a powerful resource for mobilizing community action to improve the health of residents. Currently, health data maps and other GIS applications tend to be highly technical and specialized, and are therefore of limited use to community members and organizations providing community-based health services. Developing relevant, accessible, and usable GIS and health data maps for communities and local agencies is an important step towards enabling individuals and communities to improve their health and increase their control over it. In this study, the final map of medical services of Khartoum state was prepared by overlaying all generated layers. The spatial objects were digitized. Questionnaires were prepared to get the data needed from each hospital and house by field investigation. Finally, a map of Public Health Care Information System was created by interlinking all topographical features with attribute data of the town so as to keep thisinformation for planning and development in days to come.

1.1 Why maps?

For centuries, maps have stirred imaginations and inspired explorations of the unknown. Today, maps are used to help understand relationships across areas and regions. These spatial relationships are analyzed using maps in digital form within a GIS framework. Rather than as static documents, these maps are dynamic. They can be analyzed and combined with other maps and information, charts, stories, and multimedia. GIS, together with remote sensing and Global Positioning Systems (GPS), make up the geotechnologies, which help people make everyday decisions more effectively and efficiently.

1.2 ArcGIS

Is a geographic information system (GIS) for working with maps and geographic information? It is used for creating and using maps, compiling geographic data, analyzing mapped information, sharing and discovering geographic information, using maps and geographic information in a range of applications, and managing geographic information in a database.

1.3 ArcGIS Enterprise

Is a full-featured mapping and analytics platform. It includes a powerful GIS web services server plus dedicated Web GIS infrastructure for organizing and sharing your work in order to make maps, geographic information, and analyses available on any device, anywhere, at any time.

1.3.1ArcGIS server
ArcGIS Server extensions allow GIS functionality available within a subset of ArcGIS Desktop extensions to be deployed as Web Services. ArcGIS Server extensions include 3D, Spatial, Geostatistical, Network, Geoportal, Image, Data Interoperability, Workflow Manager, and Schematics.

ArcGIS Server editions are available at two levels, scaled according to capacity: Workgroup and Enterprise. ArcGIS Server Workgroup can be deployed on a single machine to support a maximum of 10 simultaneous connections to a multiuser geodatabase. With Workgroup, the multiuser geodatabase storage capacity cannot exceed ten gigabytes. ArcGIS Server Enterprise supports distributed deployment of ArcGIS Server components, unlimited simultaneous connections to a multiuser geodatabase, and unlimited multiuser geodatabase storage capacity.

1.3.2 Portal for ArcGIS
ArcGIS Enterprise includes Portal for ArcGIS, helping you create and share maps and apps in just a few minutes. Portal for ArcGIS also gives you Web App Builder for ArcGIS, so you can build intuitive and focused web apps that run

anywhere, on any device – without writing a single line of code. Your portal provides tools for keeping your geographic assets secure, and features a set of authoritative world base maps.

1.3.3 ArcGIS Data Store
ArcGIS Data Store is an application that lets you easily configure data storage for hosting and federated servers used with your portal. If you are not a database expert, ArcGIS Data Store provides you with a convenient setup and configuration experience that creates the following different types of data stores.

1.3.4 ArcGIS Web Adaptor
ArcGIS Web Adaptor allows ArcGIS Server to integrate with your existing web server. It is compatible with IIS (Internet Information Services) and Java EE servers such as WebSphere and Web Logic. Figure (1) represents the process of ArcGIS Web.

Figure 1: ArcGIS Web Process

2. Study Area

The mapping of towns and cities (showing health centers, hospital and specialize health center etc.) and creation of databases using recent technologies have become more significantas an academic discipline and as one of the foundations for practical decision-making (e.g. in governmental, administrative and other public health care organizations) towards finding solutions of health related problems. It is generally known that the general public does not know where hospitals are located, what facilities and the kinds of specialists are available? Such problems can be addressed effectively by mapping and creating relevant databases using a GIS.

The study area of this paper is Khartoum metropolitan, capital of Sudan. Geographically, Khartoum is located between latitudes 15°26´ N and 15°45´ N and longitudes 32° 25´ E
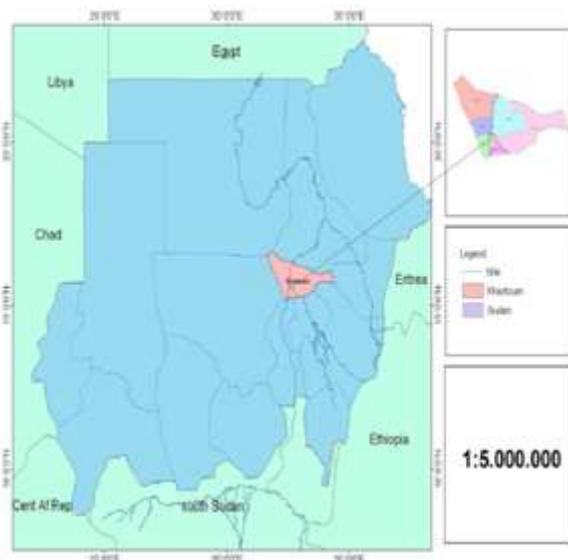

Figure 2: Location Map of the Study Area

3. Materials and Method

3.1 Materials

The study concerns with an ArcGIS Web generation of medical services for the study area. Medical services locations were determined in the map of the study area. Map of the study area was obtained from ministry of health that preview Khartoum border state from other Sudan state.

The map contains two layer one of them is Khartoum state, the attribute table contain population, area number of insurance card and family number and the other layer's preview locality border that contain location of medical service using Global Passion System (GPS), Khartoum state data are presented in table (1) and (2)

Table 1: Khartoum state Data

Khartoum State					
Locality	AREA	Cards	Population	Target	FamilyNo
Karrary	22179400	115365	238187	122822	71622
Sharq_Nile	88655400	63149	280546	217397	46626
Omdurman	751367000	44449	168513	124064	24617
Jabel_Awliya	73227500	34074	244837	210763	42903
Umbadda	475040000	68608	366344	297736	61566
Khartoum	76369500	160725	225848	65123	33573
Bahri	186244000	75393	287837	212444	45959

Table 2: Medical Services Positions (Samples)

I-C Bahry			
Eng_Name	LAT	LONG_	TYPE
Abo TlalAldroshab	15.730702	32.575429	Governmental
Ahmed Gasm	15.634648	32.532057	Governmental
AL Droshab South	15.716917	32.57742	Governmental
AL Gayli	16.010702	32.57806	Governmental
AL NgazBahri	15.623402	32.535244	Special
AL Sabay	15.634695	32.516648	Governmental
AL SdagagaGry	16.146511	32.639787	Governmental
AL Sheed Ali Abd AL Ftah Hospital	15.723673	32.580049	Governmental
AL Tawney Bahri	15.64349	32.534986	Special
AL Tyseer For Eyes	15.636718	32.524896	Special
AL Zaem AL Azhri University	15.63673	32.527841	Special

3.2 Methods

3.2.1 Study Requirements
To create a web GISserver, two PC machine are required, one to be the GISserver and the other to present client side.(ps: server software and client software can't be Install in one PC machine).

3.2.2 Server
a) Server was established using a first PC machine, and it is setup for:
    1) **ArcGIS server:**is the core server geographic information system (GIS) software made by Esri. ArcGIS Server is used for creating and managing GIS Web services, applications, and data.
    2) **Portal for ArcGIS:** is a component of ArcGIS Enterprise that allows share maps, scenes, apps, and other geographic information with other people in organization.
    3) **ArcGIS Data Store:** is an application that easily configure data storage for hosting and federated servers used with portal
    4) **ArcGIS Web Adaptor:** allows ArcGIS Server to integrate with your existing web server. It is compatible with IIS(Internet Information Services)and Java EE servers such as WebSphere and WebLogic.
b) License files were established for authorizing your software
c) A trusted certificate for enabling HTTPS(Hyper Text Transfer Protocol)

3.2.3 Client
a) The second PC was used as a client, and it is setup for:
    1) ArcGIS Catalog (v10.4):Geographic information exists in many forms, including relational **databases**, files, ArcGIS documents, and remote GIS web services. ArcGIS applications work together to allow work with geographic information and other ancillary data that exist in various data sources, including datasets, relational databases, and many file types and schemas.
    2) ArcGIS map (v 10.4)is the main component of Esri's ArcGIS suite of geospatial processing programs, and is used primarily to view, edit, create, and analyze geospatial data. ArcMap allows the user to explore data within a data set, symbolize features accordingly, and create maps. This is done through two distinct sections of the program, the table of contents and the data frame.
b) License files were established for authorizing your software
c) A trusted certificate for enabling HTTP

3.3Web GIS Setup

Web GIS will create using the following steps

3.3.1 Pre-Install
a) The Name of Machine Must be letter without symbol.
b) User Account must be Administrator Account.
c) Must create trust ports in firewall for income and outcome connections.
d) Ps (default port from esri is 6080).
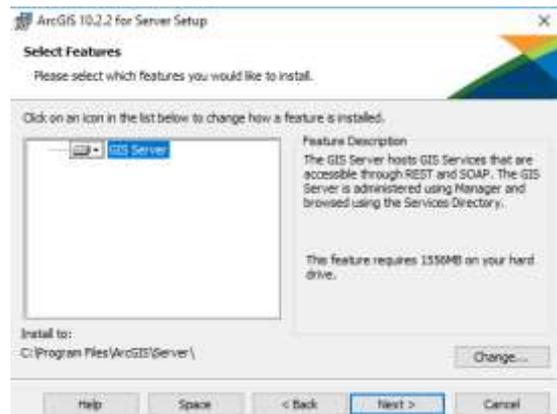
3.3.2 Installations Server

Figure 3: Install ArcGIS Server

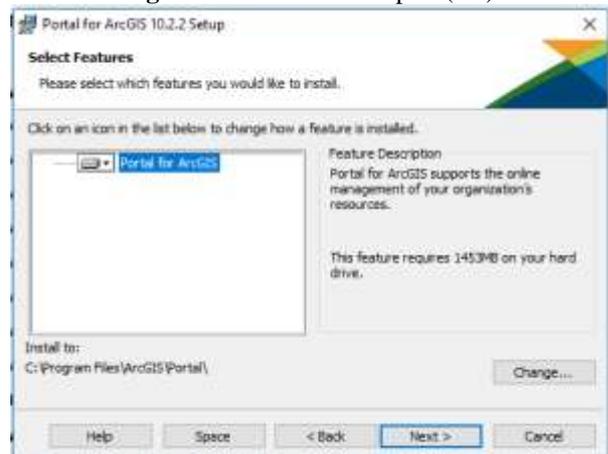**Figure 4:** Install web adapter (IIS)

Figure 5: Install Portal for ArcGIS.

3.3.3 User Administrator Creation
After Server installed, user administer was created using the following steps:
a) Add ArcGIS user to Administrator Group in Computer Manager.
b) Open Browser and write this URL:http://localhost:6080/arcgis/manager
    (Ps: localhost is modified as computer name you can change with computer name or IP Address).
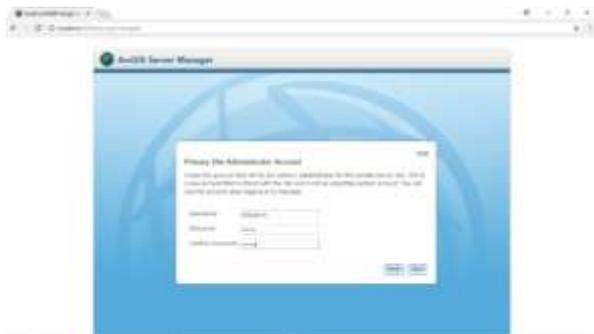
Figure 6: Create Site Administrator Account.

c) Create your site and remember your primary site administrator account username and password Open Browser and write this URL: http://localhost:6080/arcgis/admin

d) Enable HTTPS for your GIS server, open the ArcGIS security tab and enter configurations change the security protocol of GIS server from HTTPS only to HTTP and HTTPS and wait for ArcGIS server to fully restart.

Figure 7: Enable HTTP and HTTPS

3.3.4 Connection Between Server and Client
Connection between the two PC machines, server and client, had been done following next steps:

(a) On the arc catalog
1) Open arc catalog go to catalog tree click on GIS Server and select add ArcGIS Server (open window add ArcGIS server).
2) Select administrator Gis server next (general window) …. Finish.
3) The ArcGIS server well be display at the catalog tree under GIS Server to test a connection between server and client right click on ArcGIS server that added select connect (must be LAN or wireless connection between client and server with specific ip).
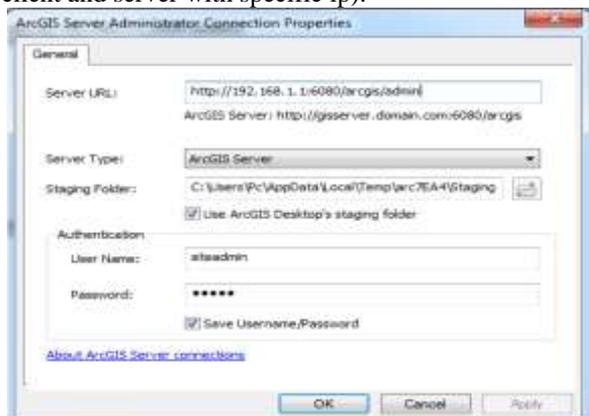

Figure 8: Server Administrator Connection Properties

(b) On the arc map
1) Open the map that prepared(The map was projected on WGS – 1984-UTM _ZONE 36N)
   The layer for Khartoum state with the locality (Khartoum, Omdurman ,Bahry ,Ombda ,East Nile ,JabalAwlya and Karry) and the attribute table contain the area, the population and numbers of cards of each locality
2) The layers of points Describe the distribution points of insurance health center with attribute table that contain name of health center, the locations (coordinate) which level and type
3) Form mean menu tab **file**select**analyze map**, check if have error you must fix it
4) From mean menu tab **file** select **share as** and enter service select p**ublish a service** And click **next** then choose **connect of the arcgis server** and choose **service name** for it (By default service name is a name of map) and click **next**
5) In Publish service to folder you can choose **use existing folder** or you can **create new folder** and click **continue**
6) In windows service Editor Press **Publish** Button after that show dialog message of the data will copy to the server press **OK**
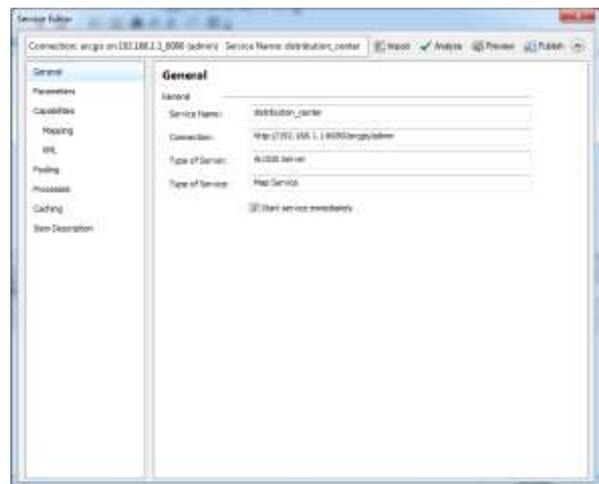

Figure 9: Server Edit Properties

7) Finally, dialog message display shows the upload and package the map and data to server as progress bar wizard. Now can go to the ArcGIS Server or we can access remotely from the client pc.

(c) In Server Side
1) Open Browser and write this URL: http://localhost:6080/arcgis/manager (Ps: localhost is modified as computer name you can change with computer name or IP Address).
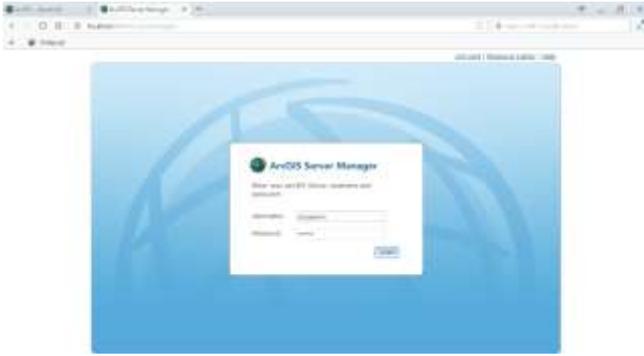2) Enter **Username** and **Password** of Administrator account of your site then click **Login**.

Figure 10: Arcgis Manager Login Page

3) After login ArcGIS server manager in main menu choose **servicers** and from sub menu choose **manager service** (All map we publish is showing here)

Figure 11: Server Manager Home Page

4) Select one of the map and click **security icon** to identified the security of the map is it for **public** (available to everyone) or **Private** (available only to selected users or roles) then **Ok**.

5) In the sub menu choose **sharing** to open sharing configurations settings in portal setting click **editicon.**Write the **portal URL** which is:https://www.arcgis.com/home write the **server URL** which is:http://localhost:6080/arcgis then chick **save**.

6) Then chick **sign in** button, dialog box displays to sign in enter **username** and **password** of your account in ESRI online as mention in above (must have Internet connections in this step).

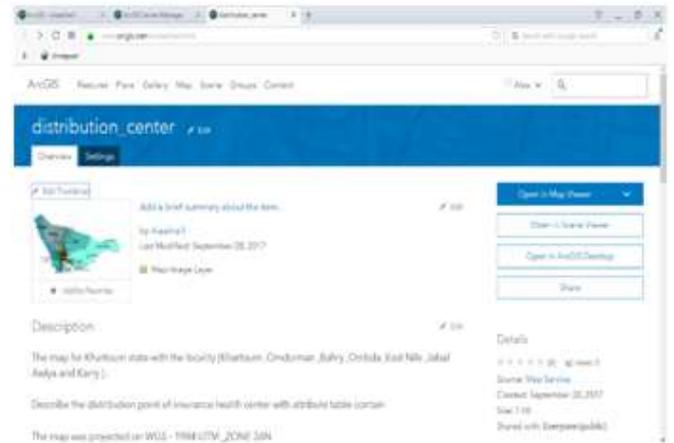
Figure 12: Sharing Page of Map in Online Account

Figure 13: Sharing Page In Service Manager

7) In the sub menu choose **manage services** select a map we want to share and chick on the **sharing propertiesicon** and Choose who you want to share your service with and click **save**.

8) Chick on the **sharing properties icon** click Portal Item Details (this action we create new browser tab and open Map Information's Online In ArcGIS Account).

9) In this page, we have a lot of information's   we can Edit them such as (name of map, creator, Last Modified, size, owner also edit descriptions, access, use constraints, tag, thumbnail)

10)Chick **open in map viewer** (to open online in browser).

Results and Discussion

4.1 Results

Finally, web map was displayed online and the user can be navigated in the map. The user can use the web map of medical services which was created. Figure(14) represents an online map.
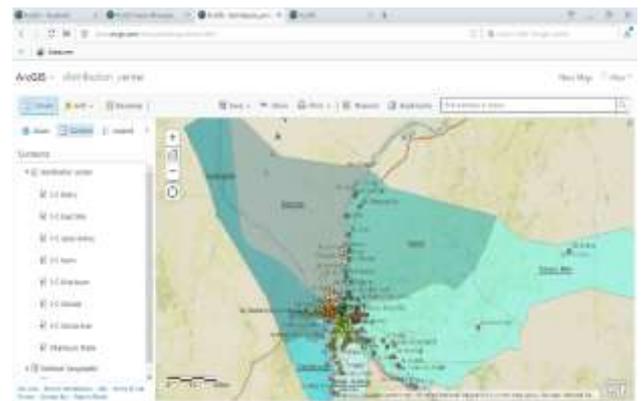

Figure 14: Map Online

Share map URL with anyone in the world or you can Embed in website or you can create a beautify web app anyone can use it. URL: https://arcg.is/1z0TrT

4.2 Discussion of Results

A created online map is serve in providing users for full information about medical services and their locations. Non specialized user can use the map easily. Unfortunately, we

don't have Static IP Address on our Server so map show online only in local server.

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