

# Using Open Source Web Mapping Application to Monitor Social Programmes: A Case Study of UNICEF Somalia

Odero Geoffrey Okoth<sup>1</sup>, Murimi Moses Ngigi<sup>2</sup>

<sup>1</sup>Jomo Kenyatta University of Agriculture & Technology, Department of Geomatic Engineering and Geospatial Information Systems (GEGIS) P.O. Box 62000-00200 Nairobi, Kenya

<sup>2</sup> Dedan Kimathi University of Technology, Department of Geomatic Engineering and Geospatial Information Systems (GEGIS) P.O. Box 657-10100, Nyeri, Kenya

**Abstract:** Humanitarian organisations often require reporting to donors on the programmes undertaken, their location, the number of beneficiaries targeted, the number of beneficiaries reached, among others. UN and other non UN agencies have formed clusters or groups that work together to deliver humanitarian assistance in the main sectors like health, education and water. Clusters create partnerships between humanitarian agencies, national authorities, local authorities and civil society. For the humanitarian agencies working in Somalia, the information about the programmes undertaken by the cluster is contained in a 4W Matrix. This information needs to be shared between one hundred and fifty members in the cluster working in different locations inside Somalia. The principle objective of the research was to develop a prototype Web application for sharing geospatial information using data from the sixteen districts of Mogadishu city. The 4W matrix was converted into GIS vector data file format and imported into a PostGIS database. GeoServer was used as the map server to publish data from PostGIS. Heron Mapping Client provided the front-end user interface while Apache Web Server was deployed to enable online access. The web application can run queries on feature attributes e.g. water sources, health facilities, schools etc. Additionally it is possible to compute point-to-point distances or find the area enclosed by an administrative district. This enables specific queries to be run on the map thus providing specific results that each agency may be interested in. Feature layers (schools, water sources etc.) can also be turned on or off, to provide for clear maps devoid of too many features. The developed application addresses the challenges that UN and non UN agencies face in sharing geospatial information. To protect sensitive information from public access, it is recommended that the web server runs behind a secure firewall.

**Keywords:** 4W Matrix, Apache, GeoServer, Heron mapping client

## 1. Introduction

Humanitarian aid is material or logistical assistance provided for humanitarian purposes, typically in response to humanitarian crises including natural disaster and man-made disaster. The primary objective of humanitarian aid is to save lives, alleviate suffering, and maintain human dignity [1]. United Nations agencies provide humanitarian assistance to many countries worldwide. UN agencies report on the programmes that they undertake to enable evaluation to be done that ensures that the intended objectives are achieved.

Since many United Nations agencies may be involved in providing aid, it is important that the activities of these agencies are well coordinated. Well-coordinated responses ensure that no duplication of effort or gaps are created. Therefore knowing which organisation (WHO) is carrying out which activity (WHAT) in which location (WHERE) and (WHEN), is essential if organisations and activities are to be coordinated in a way that ensures that humanitarian needs are met. The WHO, WHAT, WHERE and WHEN are known as the 4 W's and are put together in a matrix called the 4W matrix.

In order to ensure a well-coordinated response, UN and non UN agencies have formed clusters or groups that work together to deliver humanitarian assistance in the main sectors like health, education and water. The 4W matrix is updated regularly with the latest data from one hundred and

fifty members of the cluster. Each cluster member providing humanitarian assistance inside Somalia will require the latest copy of the 4W matrix to ensure a well-coordinated response to any emergency.

In order to make sense of the information and see the spatial distribution of the programmes, the data in the 4W matrix needs to be visualised. Data visualisation will communicate information clearly and effectively through graphical means and is an effective way to analyse large amounts of data to identify correlations, trends and patterns [2]. This visualisation can be achieved using GIS software

GIS has been revolutionising the ability to communicate the full scope of humanitarian work accurately, openly, comprehensively and in a visual fashion [3]. For organisations with a limited budget for software licenses, open source GIS software can be implemented in order to reduce overhead costs. To be able to keep track of the programmes being implemented in Somalia, a platform for sharing geospatial data was implemented.

UN agencies and implementing partners have access to the internet in most locations inside Somalia. A web application was therefore developed that provides an interactive map that visualises programme data from the 4W matrix. This web application enables the distribution of donor programmes to be seen and allows stakeholders from different geographical locations to access this information

quickly and efficiently. The interactive map was designed to allow for spatial queries to be run against feature attributes and the results obtained displayed on the map. These results can also be exported to a Microsoft Excel spreadsheet. These results are then used in the donor reports to show the current status of programmes being implemented by the various organizations.

The research focused on Mogadishu as the case study area. Mogadishu which is located at 2°4'N 45°22'E is important because it is the financial centre of Somalia and it also the headquarters for AMISOM. Mogadishu city is comprised of sixteen districts (Figure 1).

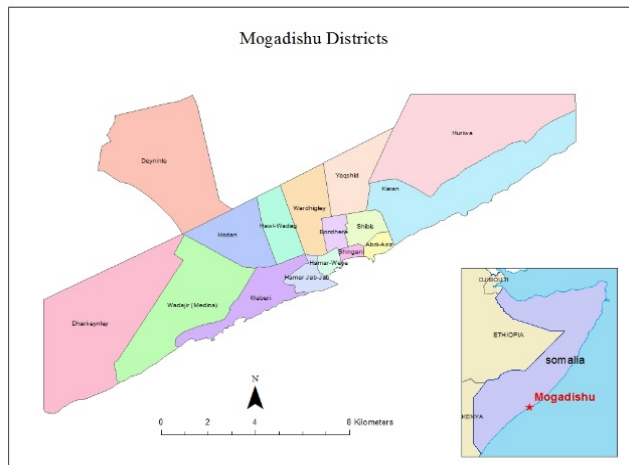


Figure 1: Mogadishu Districts

## 2. Methodology

Feedback from face to face interviews with members of the cluster operating in Somalia indicated that a geospatial information sharing platform was needed. From extensive literature review about sharing geospatial information, it was established that a four tier structure would be required. The four tiers are a database management system, map server, mapping client and a web server. The four tiers can be implemented using the following open source software: PostgreSQL with POSTGIS extension for the database management system [4], GeoServer for the map server [5], Heron Mapping Client for the mapping client [6] and Apache web server for the web services [7].

When the four tiers are implemented successfully then all that is required for the implementing partners and other stakeholders inside and outside Somalia is a web browser and internet access.

The server end was implemented (Figure 2) from the conceptual framework (Figure 3).

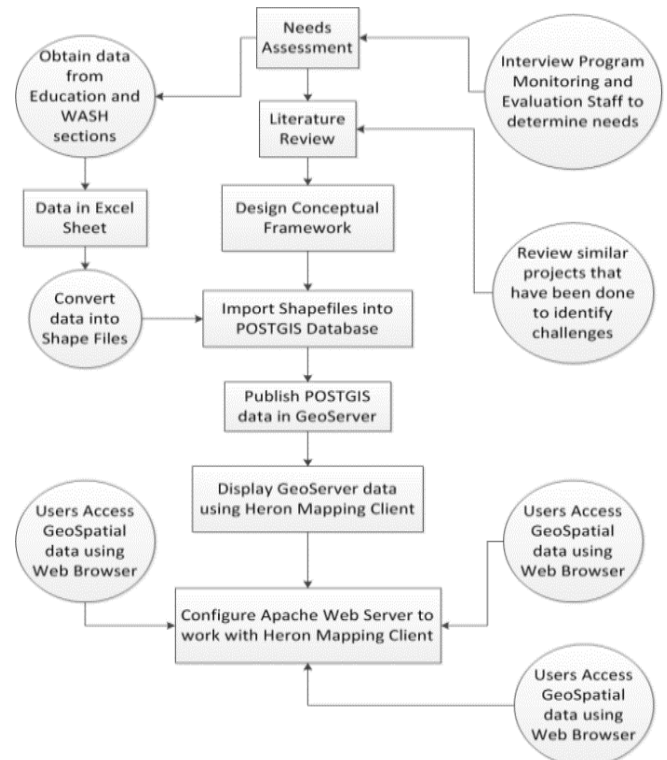


Figure 2: Methodology

The server end design uses a geospatial stack which is a set of modular packages designed and configured to work together to create the geospatial web application [8].

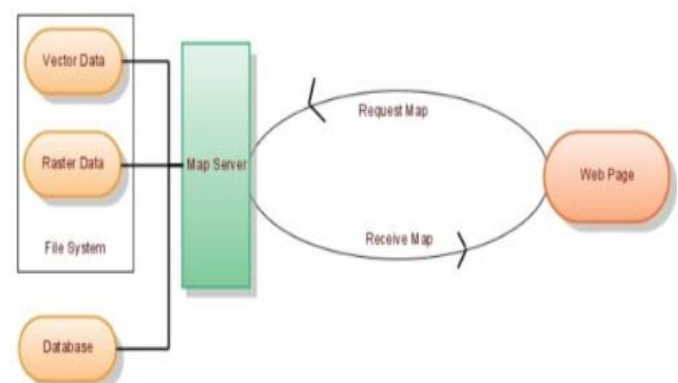
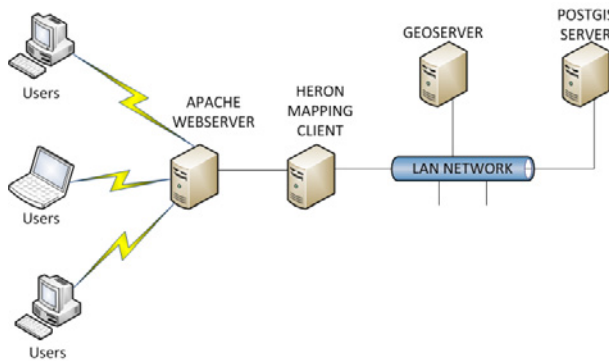


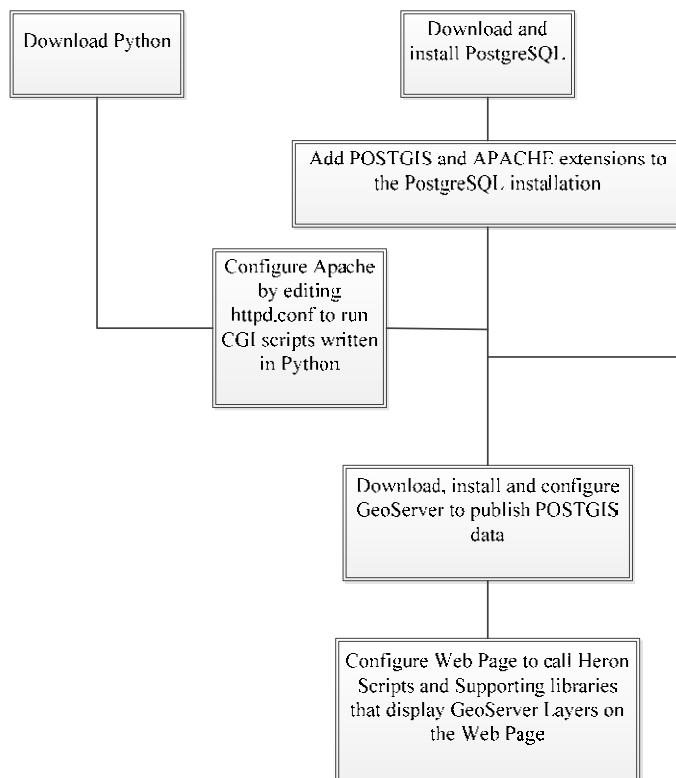
Figure 3: Conceptual Framework

The database handles spatial data types, the map server provides services to request data from the database while the interface contains the business logic and the client application allows the user to request for relevant geospatial data through a web browser. When implemented the network diagram (Fig. 4) could consist of four physical servers or one physical server with four virtual machines. The implementation mode will depend on the hardware specifications of the servers.



**Figure 4: Network Diagram**

To get the four tiers to work together (Figure 5), several customizations were done. Apache web server had the proxy service enabled through editing the httpd.conf file. Also to run the Heron Mapping Client scripts, python was installed since the scripts are written in python [9]

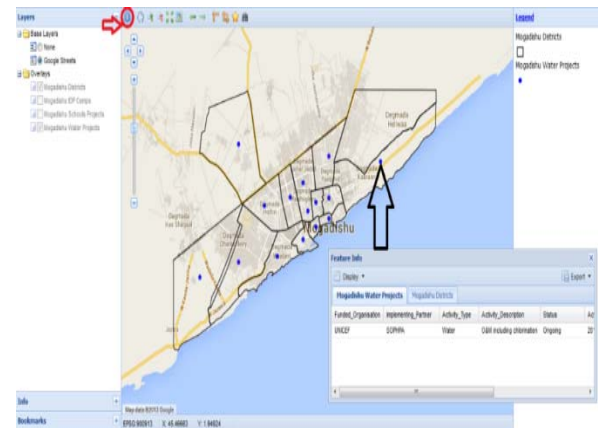


**Figure 5: Installation and Configuration Diagram**

Heron mapping client also works with GeoEXT, Proj4js Openlayers and ExtJS. These were also downloaded and configured appropriately. Several map layers were also created in GeoServer to represent the information in the POSTGIS database

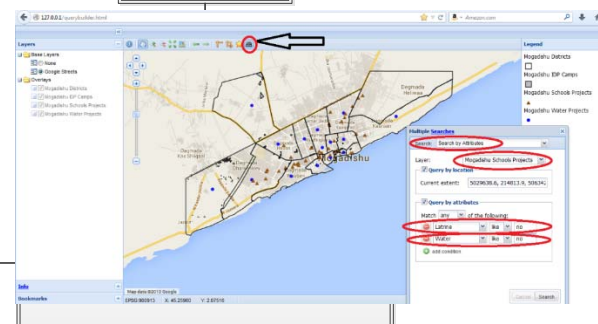
### 3. Results

The developed web application was able to achieve the objectives desired. It visualises programme locations (Figure 6) and provides further details on each programme location in a pop up dialog box.



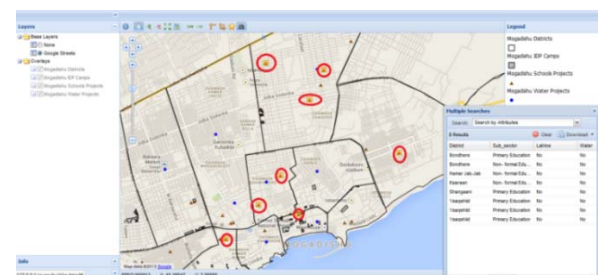
**Figure 6: Showing the 4W Matrix Visualised**

There are also three other searches that can be run on the web application i.e. search by drawing, search by feature selection and search by feature attributes. An example of a search performed on the map by feature attributes (Figure 7) shows how to select the search criteria i.e. what map layer to search and the criteria for against the map features in that layer.



**Figure 7: Search by Feature Attributes Example**

The results of the search are displayed spatially on the map (Figure 8) and also appear alongside the map in a list format. These results can then be exported to Microsoft Excel and used as part of a report.



**Figure 8: Search by feature attributes results**

This research project has been able to take information from a 4W matrix and present it has a web page on the internet. Stakeholders from different geographic locations were able to access this information through the internet. In addition the information can be exported from the web page to an Excel spreadsheet on the local computer. This method proved very effective with implementing partners.

#### 4. Conclusions

This research has shown the important role that the internet plays in sharing geospatial information. The internet provides an efficient method of sharing geospatial information thus leading to improved outcomes in the humanitarian response [10].

There is need to envisage various data entry techniques that can be used to enter programme data into the POSTGIS database directly. For example the data is captured from the field location using a gadget that then sends the information directly to the POSTGIS database via the internet or GSM network. However for this prototype the programme data is imported into the POSTGIS database from the Microsoft Excel Spreadsheet i.e. the 4W Matrix.

Additional research would be required into Heron Mapping Client to add more and more functionalities into the web application.

It is recommended that this project is implemented on two separate servers for best performance. GeoServer and POSTGIS database should run on one sever while Heron Mapping Client and Apache web server should run on the other server. These two servers need to be of very good hardware specifications if they are to handle many simultaneous requests.

Finally, there is a concern on how to allow for easy access to information via the internet but also provide secure access. This ensures that the information is only shared with the intended recipients. Cluster members then need to come up with a clear security policy guidance that delineates what is sensitive and why and provide guidance on how to share sensitive datasets.

Further research is required to enhance data entry techniques into the POSTGIS database. For example techniques utilising the GSM data network could make it possible to design mobile phone applications that could input data directly into the POSTGIS database. Further research could also enhance the querying capabilities of the system and add more features into the online interactive map.

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#### Author Profile



**Geoffrey Odera** is an ICT specialist at UNICEF Somalia. He received his B.ENG. (Honours) degree in Electronics Engineering at the University of Huddersfield in UK and is about to complete his M.Sc. degree in GIS & Remote Sensing at the Jomo Kenyatta University of Agriculture and Technology in Kenya. He has a keen interest in geospatial information sharing using open source web applications. He is also keen on spatial analysis and mobile GIS.



**Moses Murimi** is the Director of Institute of Geomatic Engineering and Geospatial Information Systems, Dedan Kimathi University of Technology. He received his B.Sc. (Honors) degree in Surveying from University of Nairobi in 1996. In 2001 he obtained his MSc in Photogrammetry and Geo informatics, from Stuttgart University of Applied Sciences in Germany. He studied his PhD in Geo environmental Sciences in the University of Tsukuba, Japan and completed 2007. Before joining Dedan Kimathi University he was a senior lecturer in Geomatics Department in JKUAT. His research interests include spatial analysis and modeling with GPS, use of open-source resources for community-based GIS participatory GIS and applications GIS in various environmental, health, and population sectors