Embedding Statistical Data into Maps using QGIS and AnyMap

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Abstract

The main focus of this study is to find appropriate and stable solutions for representing the statistical data into map with some special features. This research also includes the comparison between different solutions for specific features and found two solutions using two different technologies namely QGIS and AnyMap which are different solutions with different specialties. Each solution has its own specialty with the capability of representing the statistical data into maps depending on required criteria's.

Keywords- Application programming interface (API), Geographical Information System (GIS), Java Database

Connectivity (JDBC), Non-Spatial Data Provider (NSDP), AnyMap

1.INTRODUCTION

A map is a very powerful way to present data. It is much more intuitive than presenting the same data in the form of coordinates or text. Using the functionalities of spatial databases, along with other Middleware tools, such spatial applications can be developed that is capable to represent the statistical data into maps in various ways. In this research work a spatial application of a specific country will be designed and developed and it will show statistical data on the map (Bar chart, Pie chart etc.) and also it will show the five different layers of addresses (District, county, sub-county, parish and villages) along with other features. This study needs to find out some useful and stable solutions for embedding statistical data into maps and Compare the solutions with specific features and finally implement the appropriate solution for the specific country.

2.OVERVIEW OF DIFFERENT TECHNOLOGIES

A. QGIS

QGIS is a software program with a graphical user interface to deploy the functionalities of Geographical Information System (GIS). The QGIS application provides several tools to provide an easy way to display map layers, map legends and so on. QGIS application is free cost tool to work with geospatial data and visualized the geospatial data according to our own requirements. QGIS application is able to work with various spatial databases and display statistical data from database on the map. QGIS can load vector data from different data sources and also from shape files.
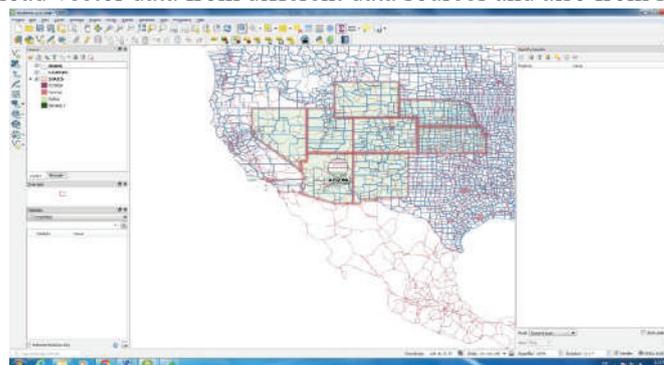

Figure 1: QGIS user interface

Geographical Information System (GIS):

Geographical Information System (GIS) is becoming an increasingly important tool in environmental management, retail, military, police, tourism and many other spheres of our daily lives [1]. GIS is more than just software, and it refers to all aspects of managing and using digital geographical data. A common feature of GIS is that they allow us to associate information (non-geographical data) with places (geographical data) [2]. GIS Systems work with many different types of data. Vector data is stored as a series of x,y coordinate pairs inside the computer's memory and Raster data are stored as a grid of values [2].

A GIS consists of:

Digital Data –– the geographical information that will be displayed and analyzed using computer hardware and software [2].

Computer Hardware –– computers used for storing data, displaying graphics and processing data [2].

Computer Software –– computer programs that run on the computer hardware and allow us to work with digital data. A software program that forms part of the GIS is called a GIS Application [2].

QGIS can use separate shape file to produce vector layers or can access different spatial databases like PostGIS, SpatiaLite and MS SQL Spatial, Oracle Spatial etc. So it is a database independent solution for any case. For adding different layers zooming capability with statistical data for each layer. If data is changed in the database then it will depicted within a few seconds in the QGIS browser. QGIS can be used as a WMS, WMTS, WMS-C or WFS and WFS-T client, and as a WMS, WCS or WFS server.

B. ANYMAP

AnyMap is a powerful product from AnyChart. AnyChart is a flexible JavaScript (HTML5)based solution that allows developers to embed interactive and great looking charts and dashboards into any web, standalone or mobile project [3]. Whether someone needs to improve their website with better reporting, embed dashboards into their on-premises and SaaS systems, or build an entire new product, AnyChart covers all data visualization needs. AnyMap is a very useful tool for side-by-side reporting [3].
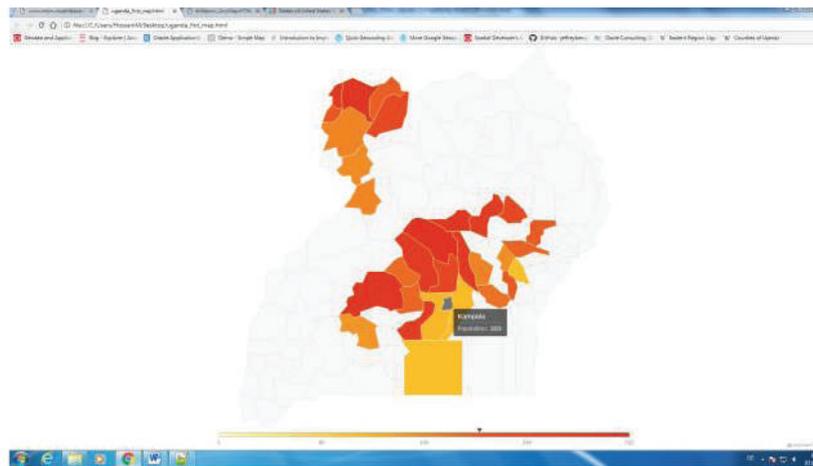

Figure 2: A simple Map Using AnyMap

AnyMap can use in online or offline. AnyMap needs to use JavaScript file for each geographical location that are targeting to display on the map. JSON file can be also used. This method is dependent to the AnyChart map data. The zoom in - zoom out feature is obtain by drilldown map otherwise it is a single layer representation with other features e.g. tooltips, different types of charts etc. When anything change happened in the database then the change will not directly depict on the map because the maps are rendered from JavaScript or JSON source which needs to be updated when there is any changes in the database. To visualize the data for a specific location from database, JavaScript or JSON data file for that specific location needs to be created. AnyMap is not a database dependent technology and it is a specialized tool for chart representations of statistical data.

3.SOLUTIONS FOR EMBEDDING STATISTICAL DATA

A. *Embedding and Evaluating Statistical Data into Map using QGIS*

Web map using qgis2web plugin
Qgis2web generates a web map from any current QGIS project and can publish a project as a web map using qgis2web plugin. To publish the layers as a web map needs to navigate:

Save current projectss→ [Web] click web menu→ [qgis2web ▸] select qgis2web menu→ [Create web map] select Create web map→select the necessary properties from the following wizard→ [Update preview] select update preview → [Export] select export

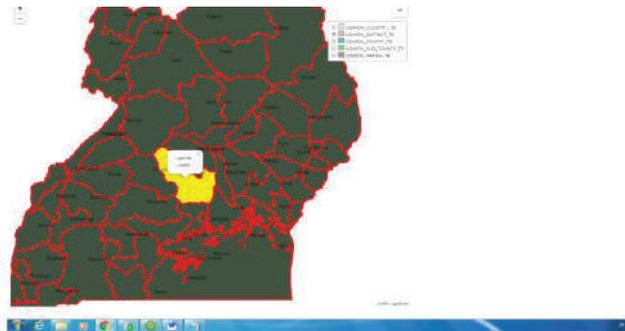When exported successfully then the exported map is saved in the default location.

Figure 3: A web map using qgis2web plugin

Create a package to convert SDO_GEOMETRY into GEOJSON
So far this study did not use any QGIS server or geoserver, here just simply create the map and used qgis2web plugin to publish the map.qgis2web plugin create a folder and store all resources to generate the map separately so that this folder is isolated from QGIS and we can use that folder anywhere and run the html file to access the map. So if any data changed in the database then the change will not take effect until create a new web map using qgis2web plugin manually. But one of the main requirements is to update the map automatically after any changes in the backend database. There are three JavaScript files which contain GEOJSON data. The purpose is to update this data source if any changes happen in the database because this study needs to display the statistics data into map which are rendered from these data source and other rendering resources will remain the unchanged. To make these things happen a package should be created which will be responsible for converting the SDO_GEOMETRY data into GEOJSON array from database along with statistical data as properties. To execute the package run the following files [4]:
SQL>@ora2geojson.pkh
SQL>@ora2geojson.pkb
After running these two files a query can be run to execute the package and get the GEOJSON output from a specific table as follow [4]:
SELECT ora2geojson.sdo2geojson('select * from states',Rowid, GEOM) FROM states;
Where 'states' is the spatial table or view and GEOM is the name of the spatial column. The ROWID is needed to collect the attributes.
The output from the above query is looks like:

	ORA2GEOJSON.SDO2GEOJSON('SELECT *FROMSTATES',ROWID,GEOM)
1	{"type":"Polygon","coordinates":[[[-114.81282.32.494221],[-113.403648.32....
2	{"type":"Polygon","coordinates":[[[-109.045143.37.375],[-109.044571.36.99...
3	{"type":"Polygon","coordinates":[[[-73.487755.42.049549],[-73.497025.41.9...
4	{"type":"Polygon","coordinates":[[[-75.788704.39.721699],[-75.788704.39.6...
5	{"type":"Polygon","coordinates":[[[-77.120201.38.9342],[-77.101501.38.910...

Figure 04: GEOJSON output from the package

B. ***Embedding and Evaluating Statistical Data into Map using AnyMap***

Drilldown Map

To achieve the zooming capability this study used the drilldown map in AnyMap. In thisstudy, statistical data for three states have been used and visualized them with drilldown capabilities from AnyMap. To do this, two JavaScript files have been created that contains functions that returns the statistical data for that specific states and counties.
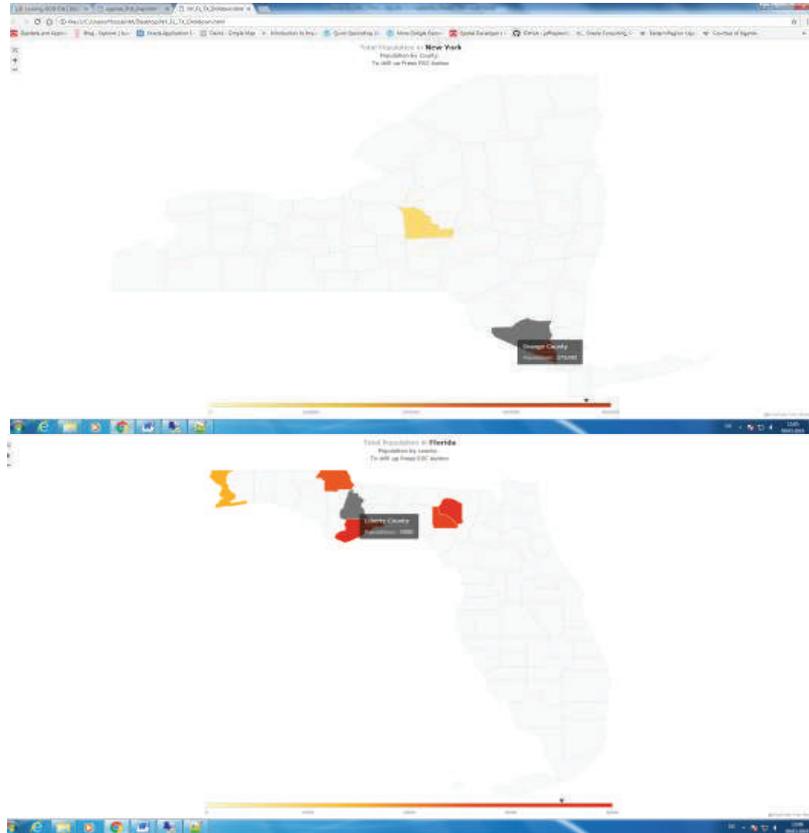

Figure 05: Different stages of Drilldown Map

Dashboard

Dashboard technique has been used to represent the statistical data into map using AnyMap, which will display statistical data into map as a chart or combo box. The output as follow [5]:
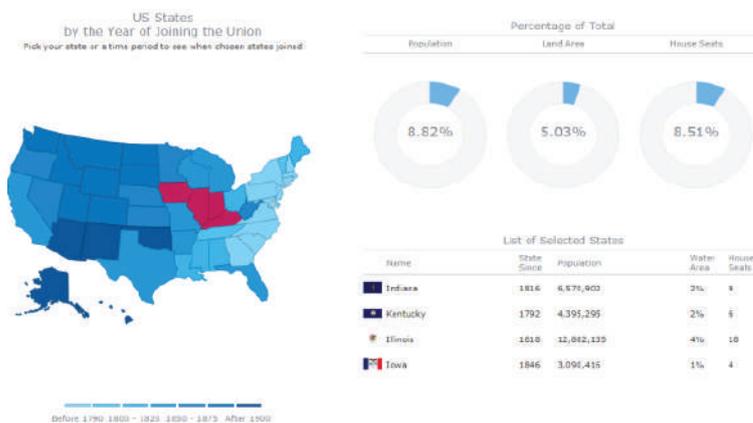

Figure 06: Dashboard in AnyMap

1.CONCLUSION AND DISCUSSION

QGIS is another GIS tool to make maps from different spatial databases or from single shape files with statistical data. AnyMap is a JavaScript solution to represent the map from data files not directly connected to the database. To determine the best solution I have compared every solutions with each other based on important criteria's. I have described the comparison details in table no. I bellow. From the comparison I would like to prefer that the solution using Oracle MapViewer might be one of the best solutions depending on the features and special criteria's. Compare with Oracle MapViewer the QGIS tool is easier to use and it's relatively simple to handle. Oracle MapViewer is a specialized tool for representing statistical data into map and works with spatial data. One major disadvantage is that it is not database independent. More details for each solution is given in the table I.

Table I: Comparison between three solutions based on important features

Feature's	QGIS	AnyMap
Does the solution depend on other service providers (e.g. maps provider)? Are there any fees?	No No cost	Yes Depends on our services
Online or offline	Offline	Offline or Online
Can I apply statistics data into the map?	YES	YES
Can I zoom into the map to get more details (e.g. borders of sub counties)?	YES	YES. Using drilldown method
Update the Map if Meta Data (Base map, Themes…) is changed	Map is updated periodically.	Possible to make it periodically
Database independent	YES	YES
Does the solution support online access to statistics databases?	YES	NO
Specialized for map rendering?	YES	YES
Depict charts in the map	YES	YES. As dashboard
Does the solution fit into the Java Universe	YES	YES

REFERENCES

[1] "A Gentle Introduction to GIS 'Introducing GIS'". [Online]. Available:
https://docs.qgis.org/2.18/en/docs/gentle_gis_introduction/introducing_gis.html. [Accessed: Dec. 3, 2017].

[2] "AnyMap 'Overview' ". [Online]. Available: https://www.anychart.com/products/anymap/overview/.
[Accessed: Dec. 5, 2017].

[3] Mapoholic, "Convert Oracle Spatial data to geojson".[Online]. Available:
https://mapoholic.wordpress.com/2015/08/30/convert-oracle-spatial-data-to-geojson/. [Accessed Dec 30, 2017].

[4] "AnyMap 'Maps Gallery' ". [Online]. Available:
https://www.anychart.com/products/anymap/gallery/Maps_in_Dashboard/States_of_United_States_Dashboard_with_MultiSelect.php.
[Accessed: Jan 5, 2018].