Creation of an automated workflow for the production of a printed map

by **Enock Seth Nyamador**

OpenStreetMap, known as the most successful Volunteered Geographic Information (VGI) source and Free/Libre and Open Source Software (FOSS) offer individuals and intitutions the freedom to innovate. Data and Software are primary components of modern map production process which are not always readily available in developing parts of the world. Using OpenStreetMap and FOSS, a general automated workflow for print map creation at a scale of 1:25000 is proposed for Ghana and Georgia. The study implements a five-stage based workflow consisting of software selection based on Multi Criteria Decion analysis. It also implemented an adjustable data model for handling own and derived changes into OpenStreetMap updates.

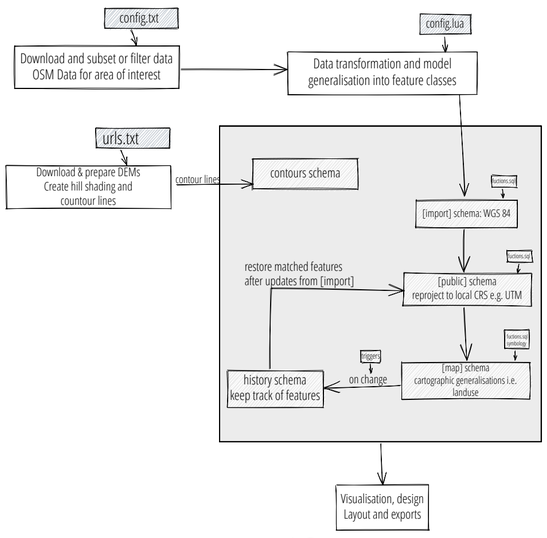

Figure 1: Workflow structure

RESEARCH OBJECTIVES

I. Create a general workflow for print map production using Open Data and using Open Source tools

II. Design and implement a method for handling geometry and attribute changes from OSM into a derived geodatabase.

DATA

OpenStreetMap is a global project to create a free map of the world from scratch made mostly by volunteers.

CGIAR SRTM is a void-filled global Digital Evelation Model (DEM) which is based on NASA's SRTM.

METHODS

Based on the cartographic process and transformations needed for map production (Longley et al., 2015) a five-stage process model was developed.

Using method for software selection proposed by Steiniger and Hunter (2013) i.e. use cases, evaluation criteria, evaluation, criteria weighting and, selection. A shortlist of alternative software was created using OpenStreetMap wiki, GitLab, GitHub, and existing researches in the domain of OSM and each stage of the workflow as represented in Figure 2.

Criteria for comparing and selection were developed for each stage based on how important the criteria contributed as shown in Figure 3 for the data preparation stage. Using the Weighted Product Model (WPM) for Multi-Criteria Decision Analysis, evaluation, weighting and best suited alternatives were selected for each stage.

For the handling of updates using an adjustable data model, methods of data conflation or data fusion from Computer Science is adopted. In order to successfully conflate data, a measure of similarity is a fundamental requirement.

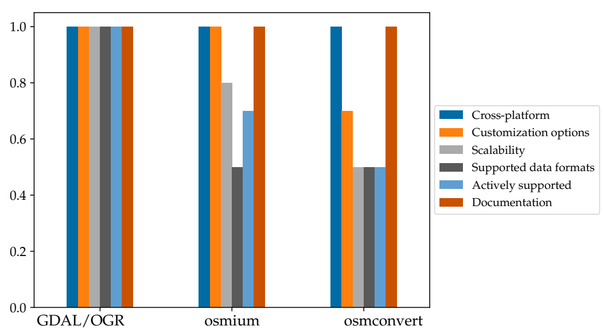

Figure 3: Criteria and scoring

IMPLEMENTATION

Bash scripting language was used as the workflow management system for the execution of processes. The preparation stage used **GDAL/OGR** for data preparation of both DEMs for hillshading and contour lines. It was also used for subsetting and preparation of non-OSM data.

The data transformation stage involved using **osm2pgsql** for model transformation into feature classes needed for map production. Data storage used **PostgresSQL** and **PostGIS** spatial extension for it's extensive spatial functions.

Some cartographic generalisation such as clustering, union, and simplification were perfromed on landuse features; this was also achieved within the data storage. Finally, **QGIS** was used for the visualisation and layout of the map output.

For the handling updates and derived changes, an adjustable data model was implemented in the data storage. This data model keeps track of changes in point, line, and polygon features. The changes are taken into consideration during restoration based on one measure of similarity and spatiotemporal recentness. Figure 4 shows an example for restoring most recent line feature.

Figure 4: Restoring changed line feature

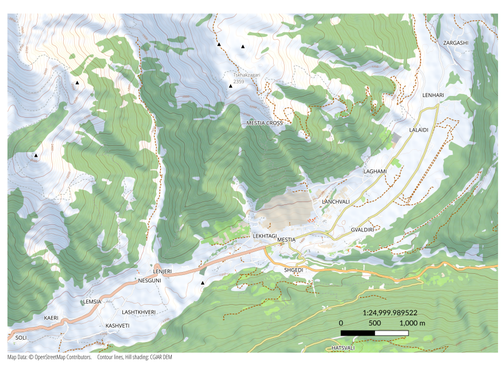

Figure 5: Result of workflow in Georgia

CONCLUSION

Using open data from OpenStreetMap and Open Source Software provides the opportunity to innovate and extend capabilities without explicit permissions.

More local active participation is required to have complete data in OpenStreetMap for map production. Local authorities responsible for map production are encouraged to take advantage of both free software; where they have the freedom to do more without permission.

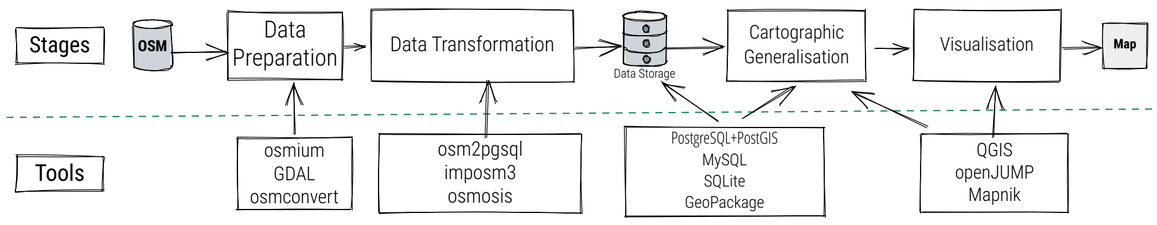

Figure 2: The map production stages and software alternatives identified

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