

Web-Based Geographic Information System for Mapping Village Boundaries

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Abstract. Management of geospatial information has grown very significantly. One example is the visualization of geospatial information which has evolved from a printed map to a web-based geographic information system. In a web-based geographic information system, information is presented in a more interactive online form according to the needs desired by the user. This study aims to compile web-based geospatial information. Data used in this study is data on the administrative boundaries of the village as the research area and other map data. The research method used is integrated utilization of a geographic information system with a programming language and web server. result of the research is a web-based information system that provides information on the boundaries of the village area with several layers of data, both vector and raster data. Therefore, a web-based information system can provide great benefits to the community, especially the government and public in the area of the village government concerned.

Keywords: Web-based geographic information system; geospatial information; village

1 Introduction

Geospatial information has experienced a significant increase in line with technological developments. These developments produce a variety of more recent innovations. Especially in the 2000s until now these developments are evident with more sophisticated geospatial information processing computer devices. However, developments in terms of visualizing geospatial information are also experiencing simultaneous development.

Visualization of geospatial information is generally in the form of maps printed on flat media and the globe. In development, visualization in the form of printed maps and globes is considered a conventional and normative way. The use of printed maps is often used as a complementary administrative document in several formal and non-formal activities. Other things in the world of education printed maps and globes are still often used as learning media. However, in line with technological developments, geospatial information can be digitally visualized which is more interactive.

Geographic information systems are computer-based systems that function to collect, manage, manipulate, analyze, and display spatial information (Prahasta, 2009). The result of a spatial information system is an informative visualization of geospatial information. Regulation of Indonesia No 4 of 2011 concerning geospatial information declared is geospatial data that has been processed so that it can be used as an aid in policy formulation, decision-making, and implementation of activities related to terrestrial space. Therefore the

need for geospatial information in every aspect, especially as a reference in public policy-making by the government.

The smallest government unit in an administrative area is the village. The term village within the scope of Minangkabau society in West Sumatra Province is called Nagari. One of the complete administrative documents of villages is a map showing geospatial information, especially administrative boundaries. This is in line with the Regulation of the Minister of Home Affairs Number 45 of 2016 concerning that the determination and confirmation of village boundaries aim to create an orderly government administration and provide clarity and legal certainty to the territorial boundaries of a village that fulfill technical and juridical aspects. Therefore each village needs to have a map as a reference in the process of government activities.

Village administrative maps can be visualized in the form of printed maps. However, one of the innovations that have developed in recent years is the online visualization of web-based geospatial information. Using this web-based system can provide interactive and interesting visualizations. The purpose of this research is to develop a web-based information system for mapping village boundaries.

2 Research Method

The research was conducted in Lima Puluh Kota Regency, West Sumatera Province. The study area has an area of ± 336.732 ha. Lima Puluh Kota Regency consists of 96 villages and sub-districts with the largest village area of ± 29.048 ha (Nagari Gunung Malintang) and the smallest village area of ± 11 ha (Padang Karambia). Lima Puluh Kota Regency is bordered by Riau Province in the North and East, Tanah Datar Regency and Riau Province in the South, and Tanah Datar Regency and Agam Regency in the West.

The data used are administrative boundaries and geospatial data. The data is sourced from regional administrative data in Indonesia. Some other data such as satellite imagery also used in this study. Geospatial data processing uses software, namely QGIS, which functions to manage and display administrative boundary data. Some other software namely PostgreSQL-PostGIS Database, Geoserver as media conversion, and geospatial data viewer. Creating a programming language using HTML and Javascript. Furthermore, the integration of some software produces a web-based geographic information system

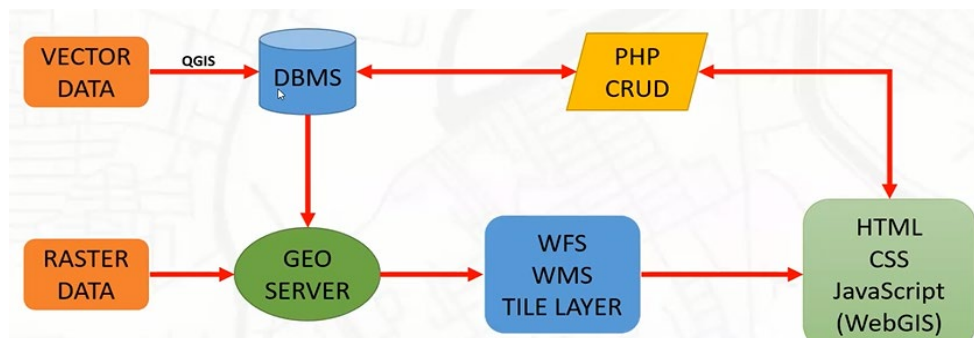


Fig. 1. Flow of a web-based geographic information system.

3 Result and Discussion

A web-based geographic information system is a visualization of geospatial information in digital form. The visualization of geospatial information is displayed online. Data used can be in the raster data and vector data format. However, the data is first converted into several forms, namely WFS, WMS, and tile layer. WFS (web feature services) is described in features or raw data form. WMS (web map services) is described in image form. While the tile layer is a conversion of satellite imagery data and aerial photographs as a basic reference for geospatial information to be displayed in administrative boundaries data. The data is sourced from the regional administration of Indonesia. Some other data such as satellite imagery also used in this study.

The development of a web-based geographic information system for mapping village boundaries has been widely used in the last 10 years. Villages need a web-based Geographic Information System (GIS) system that aims to manage village data, both spatial data and attribute data in the form of interactive maps (Syafriani et al, 2009). The mechanism for preparing the system also tends to be easy to implement. The first stage starts with the installation and creation of a database in the PostgreSQL software. Then convert shapefile data of administrative boundary in line or polygon forms. The next step is to make a connection to Postgis and connect it. Some of the processing stages use PostgreSQL and QGIS software.

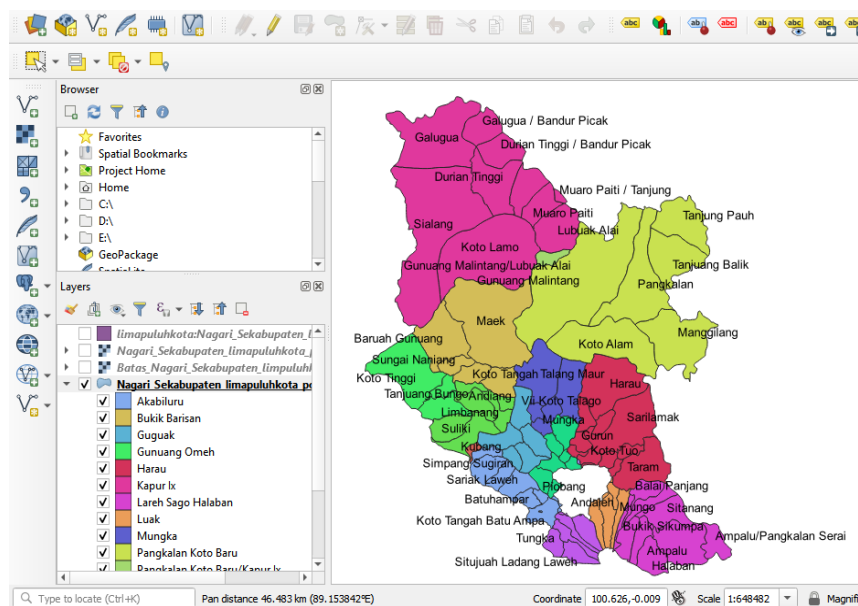


Fig. 2. Conversion of shapefile data to postgis data

The next stage is connecting PostGIS data with the server. This stage aims to enter village administrative boundary data so that it can be visualized and web-based. software used in this stage is Geoserver. Data formats that can be included in GeoServer consist of GIF, GeoTiff, JPEG, OpenLayer, PDF, PNG, and SVG. CSV, GML, GeoJSON, KML, Shapefiles, etc. These

various data formats certainly make it easier for users. At this stage, the researcher inputs administrative boundary data in polygon and line form.

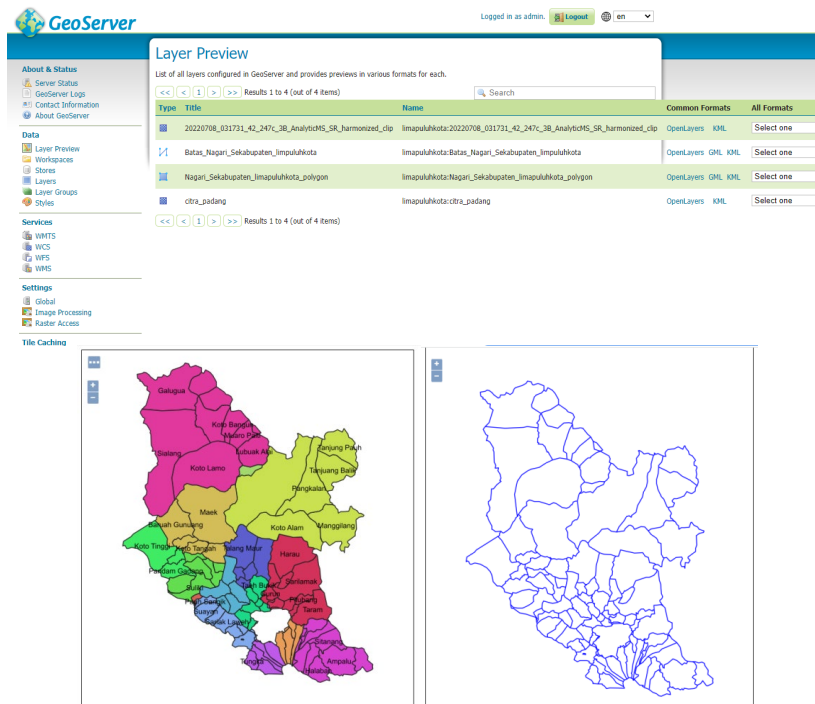


Fig. 3. Visualisation of geoserver

The stages of compiling an absolute programming language are carried out in a web-based geographic information system. The programming language that uses HTML and javascript. Through the use of programming languages, users can arrange and design web appearances creatively. Starting from the appearance of the interface, the menu, tools, and symbology can be arranged freely. In this study, each village is given a color symbol that tends to contrast to make it easier for users.

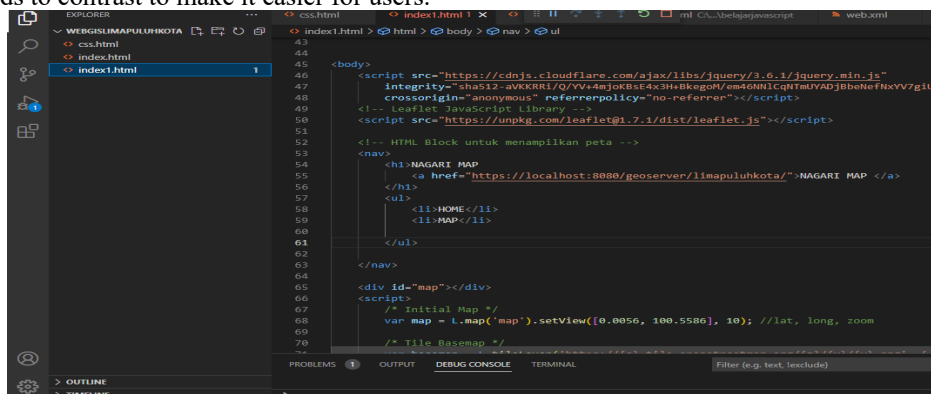


Fig. 4. Visualisation of html

The result of a web-based geographic information system is a village WebGIS that shows the administrative boundaries of the village in the Lima Puluh Kota Regency. WebGIS also contains basic data for open street maps and open top maps copied from leaflet providers. The data is presented free of charge for user convenience. Users can direct hover over a village to find out the attributes of the selected village, for example, information on districts and villages. Among the several advantages of using WebGIS, there are also disadvantages to its preparation. Trisna & Susanta (2021) stated that errors often occur when loading the dashboard on the map page. Therefore, high accuracy is needed in compiling all the completeness in preparing the WebGIS village.

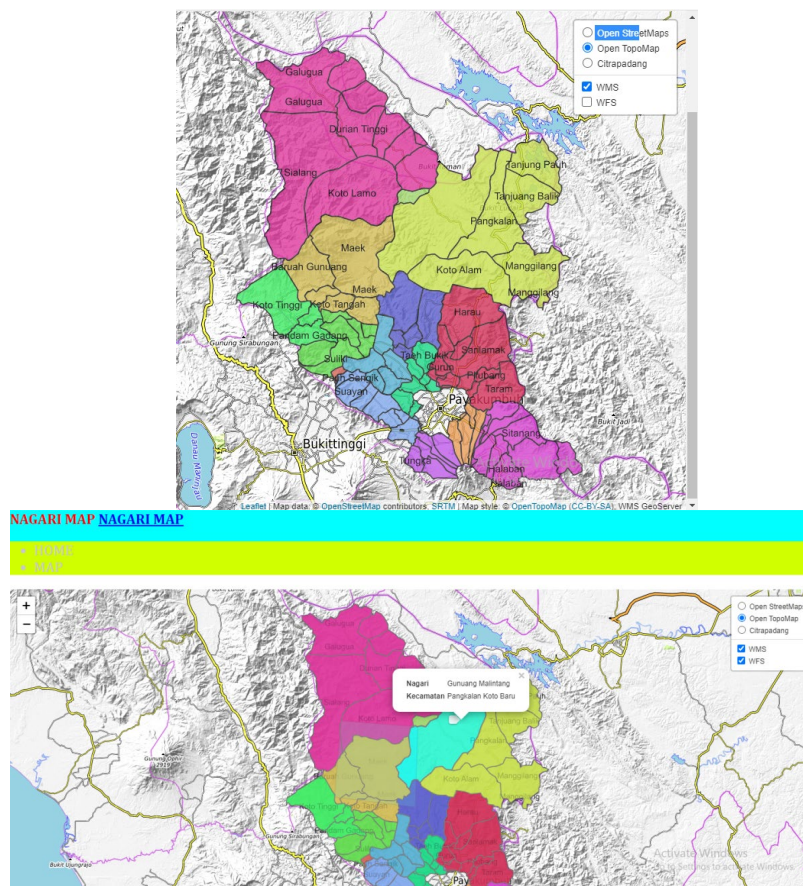


Fig. 5. Visualisation of WebGIS Nagari

4 Conclusion

Web-based geographic information systems are very useful in visualizing the geospatial information of villages. This information is one of the most important administrative tools for the village. Geospatial information is also used for the management of existing resources that serve to improve the economy. Through WebGIS, people can find out the potential of their

region. Parties from outside the area can also find out spatial information and existing potential, for example for investment purposes.

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