

Development of Web Based Rural Utility System Using Open Source Geospatial Tool

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Abstract— The planning and execution of any economic policy for a nation like India has to begin with villages. Government of India has recently launched new programmes like ‘Digital India’ which is an initiative to create the digital infrastructure, digital literacy; and ‘Sansad Adarsh Gram Yojana’ which is a rural development programme broadly focusing upon the development in the villages. Rural utility management system serves as an efficient system, designed to customize and integrate web GIS system based on open source tools for effective dissemination, sharing and management of spatial information related to utilities in village and its development. The present study deals with the development of web interface for utility system for Gangadevipalli village in Telangana by using open source geospatial tools such as Openlayer and Geoserver. This Web interface will help the local people and the administration to efficiently manage and develop the existing utilities of this village.

Keywords-WebGIS; FOSS4G; Geoserver; QGIS; PostGIS:

I. INTRODUCTION

GIS applications are critical to many aspects of governance and nation building and can help in economic and social development. Village WebGIS utility mapping system can help local authority in Decision making and development of these utilities. The web applications are advantageous in platform independency, low cost of data distribution and sharing of the Geospatial information. The development of Web GIS architecture using Open Source Web GIS tools like Geoserver, PostGIS and OpenLayers allows the user to operate the system without any prior knowledge of GIS. This paper is aimed to provide a method for visualizing the geospatial data on web using a combination of FOSS4G tools.

II. COMPONENTS OF WEB GIS

Various components of Web GIS are Database, Server, Map viewer and SDK.

A. Database

The common database for GIS is standard database management systems (DBMS) with spatial extensions. There are two well-known free databases available: PostgreSQL and MySQL. The PostgreSQL with the extension PostGIS better supports the OGC standard than the MySQL. Hence the PostgreSQL is opted for the case study.

B. Server

Server is used to get the client requests and respond according to the requests. The GIS servers considered are Mapserver and Geoserver. Mapserver lacks the transactional feature for the WFS and has less architectural overhead with respect to Geoserver. Moreover Geoserver provides interactive GUI, hence the Geoserver is opted.

C. Map Viewer

Browser support without plugin is considered for choosing map viewer and Asynchronous JavaScript and Extensible Markup Language (AJAX) based map viewer is preferred as it reduces the processing bandwidth. The Open Layers is chosen as the map viewer because it is one of the most popular viewers and supports WMS, WFS, KML, GeoRSS and GML. It also provides API for Google Maps and Bing Maps.

D. Software Development Kit (SDK)

Software Development Kit is a set for software development tools used to create the applications. Boundless SDK is used to build and deploy web mapping applications based on the JavaScript. This involves five stages creation, customization, testing, packing and deployment of the application. The application is packaged as web archive (WAR) and can be deployed in the application server.

III. METHODOLOGY

Methodology adopted for the creation of the web application consists of data preparation, Database Management, publishing data to spatial server and Application development.

A. Data Preparation

ESRI Shapefiles were created by digitizing the High Resolution Google Earth Imagery and field survey. The styling and editing of shapefiles was done using QGIS which is open Source desktop application.

B. Database Management

GIS database management: Spatial database in PostgreSQL was created by shapefile loading Tool pgShapeloader. The pgShapeloader makes shape data usable in PostGIS by converting it from binary data into a series of SQL commands that are then run in the database to load the data.

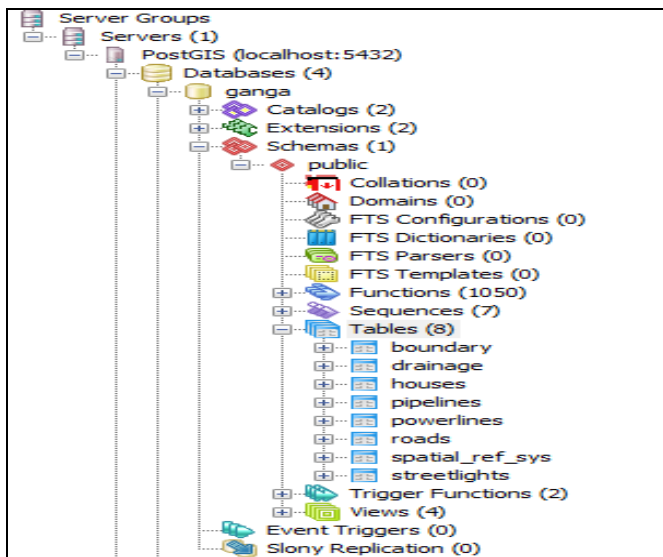


Figure 1. Database created in postgresQL

C. Spatial Server

Geoserver was used to publish shapefiles which were imported from PostGIS. Fig 2 shows the open layer preview;

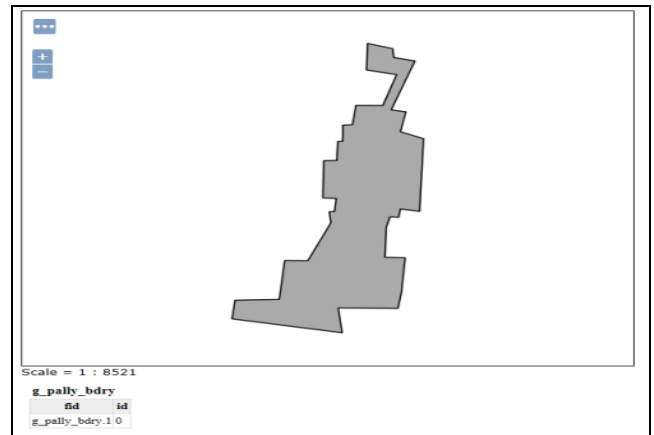


Figure 2. Layer preview in OpenLayers.

D. Application Development

Boundless SDK was used to create the web Application. The application was created in gxp application template which is based on gxp, geoext and openlayer javascript libraries.

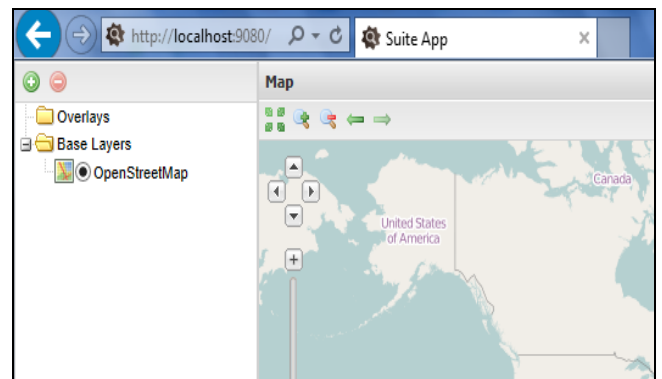


Figure 3. Default Interface created by SDK.

IV. CUSTOMIZATION OF APPLICATION

The openness and flexibility of the web platform enables customizations that would not have been possible on the desktop. We can use OpenLayers JavaScript libraries to customize our web application.

A. Adding new Base Map

Once the application was created by SDK, it was run in debug mode on localhost. The basic default viewer which was created is shown in fig 3 which contain OpenStreetMap as base layer. First we set the Base layers center point and Zoom level which enable application to show the area of interest everytime we start the application.

B. Adding Various Shapefiles of utilities

Various ESRI shapefiles were added like houses, roads, streetlight, drainage, pipelines, powerlines and village boundary. These shapefiles were published using Geoserver and were used in the application as WMS and WFS services.

C. Customization of spatial tools

Zoom to Layer Extent is used to zoom to full extent of a particular layer. So this tool was added to the toolbar on top of the layer tree, and to the context menu that appears when we right-click on a layer in the tree.

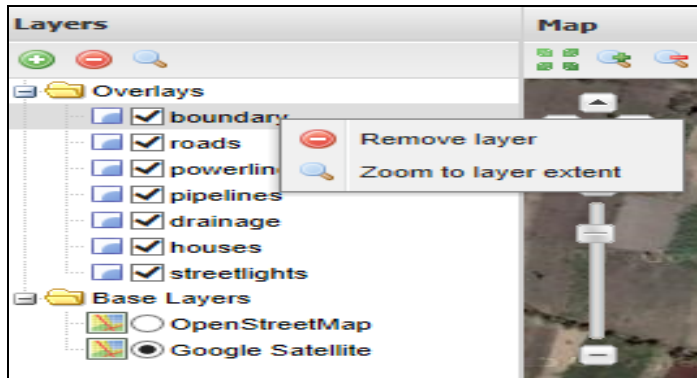


Figure 4. Zoom to layer extent tool

Next step of customization was to add various tools to the application source code which was stored in app.js file. Various tools were added to interface like WMS GetFeatureInfo tool, Google Geocoder search field, Create New Feature tool, Edit existing feature tool and Manage Layer Style tool.

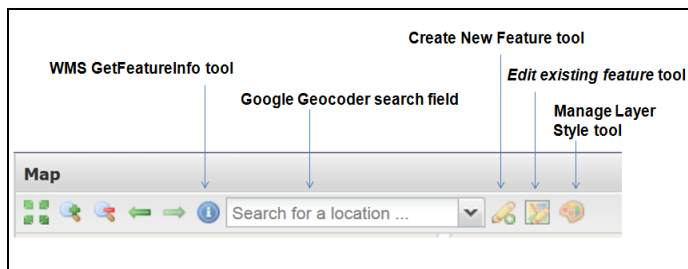


Figure 5. Customized tools added to web interface

Edit existing feature tools (fig 6) can be used to edit the existing features which we want to change for updation. It will show all the details associated with the feature in the attribute table of selected feature.

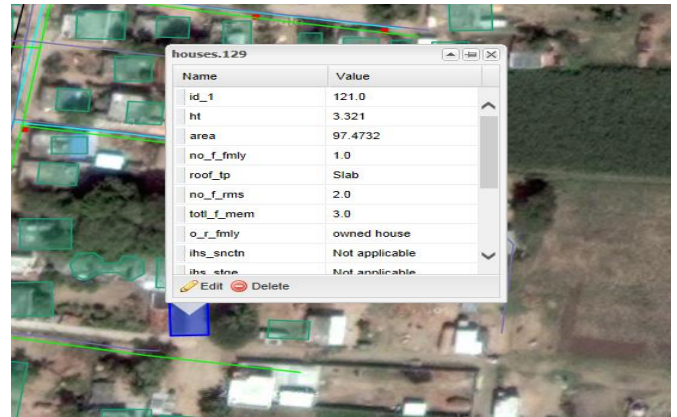


Figure 6. Use of Edit existing feature tool.

Create New feature tool allows (fig 7) users to create new feature which would be added to the existing utility system. We can fill all the required fields and then that feature would be updated in in the geoserver layer.

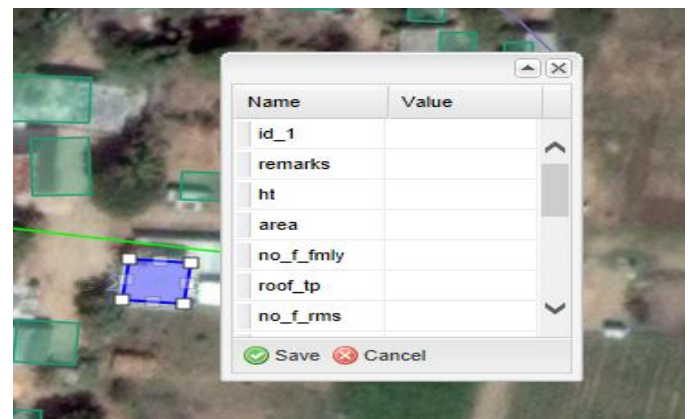


Figure 7. Use of Create new Feature tool

Final web Interface created are shown in Fig 8 and Fig 9.

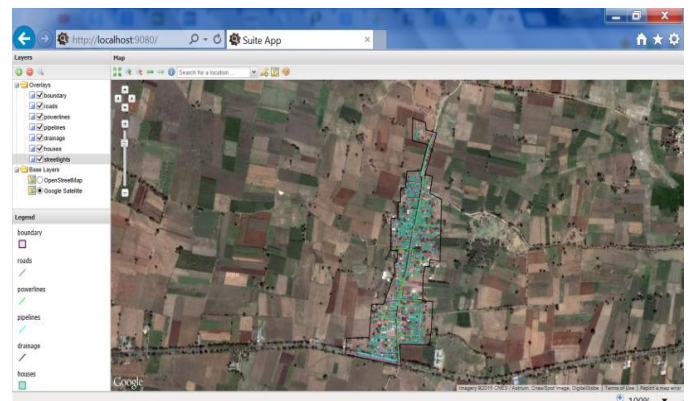


Figure 8. Web Interface with Google satellite imagery as basemap.

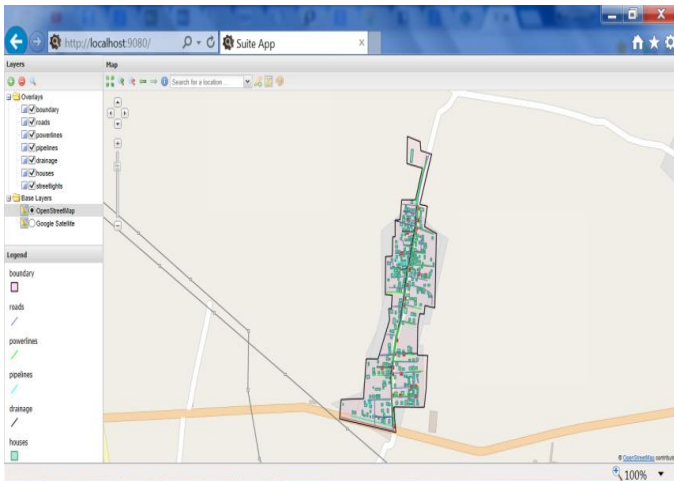


Figure 9. Web Interface with OpenStreetMap as basemap

V. CONCLUSIONS

In this paper a basic web application was developed for village WebGIS Utility mapping system for Gangadevipalli village. The paper focus on the use of FOSS4G tools to develop interactive WebGIS applications also the process and methods of comprehensively using Geoserver, PostgreSQL, PostGIS and GeoExplorer, OpenLayers for creat WebGIS applications. Use of open source technologies provides a low cost solution for web publishing of geographic information.

Further work includes adding more geospatial tools like measure, buffer, union, intersection, etc. and higher level of customization of the interface.

ACKNOWLEDGMENT

Authors are thankful to Mrs. Y. Navatha for providing Gangadevipalli village spatial and non-spatial data for the study.

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