

WebGIS– Based Solution for Parking Slot Allotment in Defoliated Area

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Abstract—In today's modern world, parking vehicles in a defoliated area in real time is the most challenging task. To meet this requirement of the user, an application which consumes less cost and saves time is required. This paper presents such an application, where geospatial information is retrieved from satellites and analyzed to extract the information related to geography of the world from the GIS service. Using WebGIS through web browser displays the solution on the map for vehicle parking which can handle huge amount of data. This application helps the user to make smart decision based on the availability of the parking slot conveniently.

Keywords- WebGIS; OpenLayers; OpenStreetMap; PostgreSQL; Geoserver; Postgis; Quantum GIS; Java Unfolding;

I. INTRODUCTION

A Geographic Information System (GIS) is an automated system that enables a user to capture, store, integrate, manipulate, analyze, and display data that are spatially referenced to the Earth (a specific location)[1]. Maps are means of communication for geographic knowledge. When the decision needs to be taken by the user, GIS helps us gather place-based information and organize it on a digital map. Traditional cartographic paper maps are static, quickly become outdated, are expensive to update, and can only represent a single specific scale of spatial data per map. GIS provides the user the ability to view the data at different scales or zoom levels and with different layers of information or datasets. It is basically a high-tech electronic map that can be easily manipulated.

The Web changes everything. Web GIS, the combination of the Web technologies and geographic information system(s) or science(GIS), has grown into a rapidly developing discipline since its inception in 1993. GIS has turned into a compelling Internet application that has prompted many people to take advantage of the Web. The vast majority of Internet users use simple mapping or other spatially enabled applications over the Web at some point, though many are not aware of it [2].

Web GIS is obtained from a combination of two, web technology and the Geographical Information System, which is mainly composed of data handling tools for storage, management, recovery and analysis of spatial data. Web GIS has a distributed information system. It can be used for land routes, educational, agricultural details, sea routes etc. that can later be used by the users, depending on their application.

The geographical data obtained in the GIS system from the real world are in the terms of their position with respect to their current location or known co-ordinate system. The data obtained are unstructured in nature. These data make up terabytes of data and it is increasing exponentially. Storing and maintaining such data without getting any business information out of it just a loss of business value.

GIS integrates all kinds of information and applications with a geographic component into manageable system. Therefore the benefit of GIS application is their ability to integrate and

analyze all spatial data to support a decision making process. Integrating this GIS system with Web makes an easy access to the geographical data to the user.

In current vehicle parking system there should be either the mechanical devices being attached to the vehicles and record the information based on which it shows the parking location for the user or an app to be installed which requires frequent updates whenever there is a modification of the source. In this paper we discuss about using the geographical locations and parking slots available from the Global Positioning System (GPS) in a web based system and give an user with easy and compatible application which helps the user to get the parking location based on the current location.

II. RELATED WORK

There are few works that are carried out in WebGIS area. In Development of Web GIS Based Digital Avalanche Atlas[3] provides the very useful solutions for improving decision making, data management and visualisation, open source software are being which are easily available and thus reducing the cost for developing large projects. The paper also describes about the webgis application low cost and ease of use.

A Study of WebGIS Platform Based on Acceleration Engine [4] proposed an acceleration engine, this engine is applied on webGIS platform to address the problems like index caching, client data sharing and collaboration by developing a new webGIS architecture.

In Study on the Crop Suitability Analysis System Based On WebGIS in Henan[5] a research paper uses government growers and farmers with operation and guiding agricultural production as purposes and using GIS system it gives the significant suggestions on agricultural planting. In the paper, Implementation of the WebGIS of East China Sea Seafloor Observatory System[6] provides a WebGIS system a practical channel for analyzing and sharing of the marine data which helps in increasing the utilization of the data for decision making.

III. DESIGN APPROACH

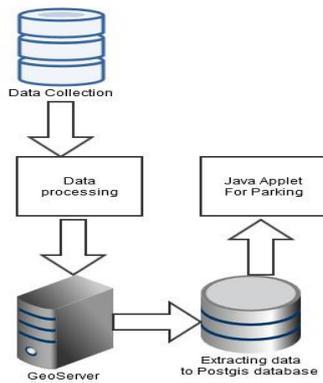


Figure 1: Design approach

Figure 1 shows the Design approach. It involves the following steps:

- Collecting the data from GPS which receives data from number of satellite that helps in giving accuracy of the data received.
- The obtained data consists of huge number of bias or may be unwanted data for particular application. Hence the obtained data is preprocessed through various softwares.
- The obtained geospatial data has enormous range from giga bytes to petabytes. Geoserver is being used to store this large amount of data.
- The data stored in the geoserver is extracted and stored in postgis database which provides multiple operations on spatial data, which can be queried and used for developing application
- Java applet can be created using this data from the postgis to locate the nearest possible parking location.

IV. IMPLEMENTATION DETAILS

4.1 Design Architecture:

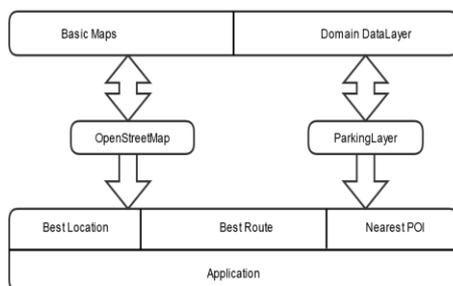


Figure 2: Design Architecture

Figure 2 shows the design architecture of how to develop an application for a parking slot.

In this architecture, we use Openstreetmap as a base map. OpenStreetMap (OSM) is an open source map available for the developer which doesn't require any licence to make changes on the map. This map is freely available to the developer where many operations on the map can be carried out without any licence requirement. OSM provides free editable map of the world where the data on the map can be used to develop different kinds of application. OSM doesn't restrict for the availability of the map and it uses highly efficient satellites to record the map data which will be made available to the developer to use the data required the application.

Domain data layer is used on this base map OSM. This domain data layer can be of the application interest like this layer can be the data which is used on the base map to represent the features like the routes on the map, hospitals, pubs, parking slot etc. These data are obtained from the GPS which collects the data from the satellites. If the GPS collects the data from large or if the number of satellites which is collecting the data increases the accuracy of the information or the data collected will be high. These data are stored and used on the OSM as a layer to represent its features.

Once this data has been added on the base map, the required application can be developed. In this paper we add OSM as a base map and parking slots as the domain data layer. The application required to locate the best location for the parking can be developed, Best route as well as nearest point of interest (POI) can also be implemented in the application.

4.2 Detailed Implementation:

In this paper we discuss how a plugin is developed on Quantum GIS (QGIS). QGIS is an open source tool available to develop the plugins required. It is most popularly used for developing desktop GIS applications. It provides enormous features and makes easy for developing.

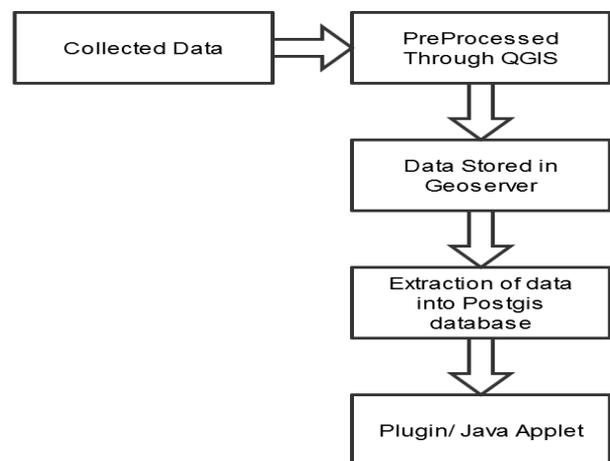


Figure 3: Implementation Process.

DataCollection: The raw data is collected from the global positioning system(GPS) . The data is collected from the navigational satellites. Collected data will be in the form of

traces, known as GPS trace. Upto 4 satellites are used to fetch the data from the satellites which provides accuracy of the collecting information. The data collected will be very huge it ranges from gigabytes to petabytes. The obtained data will be traces of how the satellites records based on their movement. The GPS receiver which is used in collecting this data should be set to WGS84 coordinate system which is considered as very nearest coordinate to Greenwich meridian. The OSM map provides compatibility only for WGS84 system if other coordinate system is being used then there might be small or huge difference on representing the data on the OSM to prevent this differences the GPS receiver is set to WGS 84 system.

The obtained data from the GPS receiver may contain unrelated data or the bias which causes error in representing on the OSM. Hence the obtained data should be subjected to preprocessing.

PreProcessing:

Preprocessing of this data can be done in various ways using various software available. The obtained data from GPS receiver may or may not be in GPS Exchange format (GPX). If the data is not in GPX format the data needs to be converted into GPX format before it is used on the OSM. The OSM map accepts data only in GPX format, hence there is a need for conversion of the obtained data. This conversion and preprocessing can be done using software like GPSBabel or QGIS.

In this paper we use QGIS to preprocess the obtained data from GPS which converts the data into GPX format which can be efficiently used on the OSM map without any loss of data. The data on the QGIS can be extracted using two readily available plugins i.e., Openlayers and OSM place search. Openlayers provides the base map required for the application here we use OSM as base map. OSM place search is used to extract the data from openstreetmap.

DataStorage(GeoServer): The obtained data is very huge which consumes lot of storage place. Storing this geospatial data on a local machine is of high risk hence this data can be stored into Geoserver, it is opensource server which provides the user with huge amount of memory to store the data. The geospatial data obtained can be stored into geoserver. Geoserver not only provides the storage area for the geospatial data it is also an open source hence any user can access to this server, use the data available in the geoserver, edit the information in the server. Geoserver provides different services based on which the data can be stored for example it provides wms and wfs services in which the data can be stored. The obtained is stored in the geoserver using wms services. The geoserver has list of data stored. In this paper we use parking layer from the geoserver which is represented as wms layer on the OSM.

PostGIS Database:

The data stored in the geoserver is extracted or stored into postgis database. Java applications can be developed using this postgis database to add layers onto the map as wfs services. In this paper we focus on developing a plugin on QGIS tool for locating the best location for parking based on the current position.

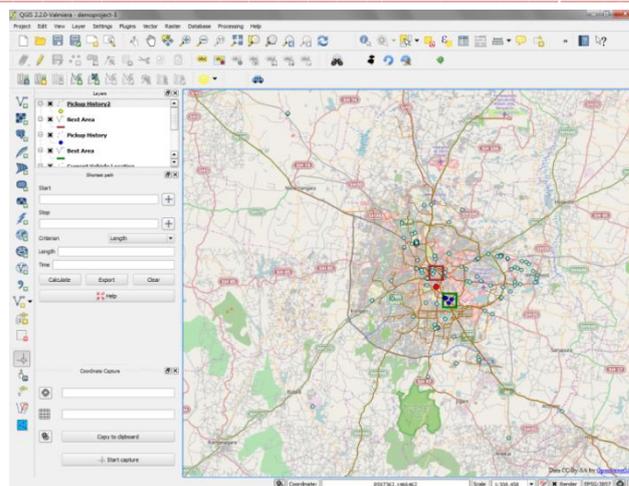


Figure 4: QGIS plugin for parking.

Figure 4 shows QGIS car plugin developed. The menu bar has a small blue color car plugin developed.

Initially the plugin is developed to which the base OSM map is loaded on the QGIS tool. A connection to the geoserver is made and wms service of the data is selected from the geoserver. Here we add two data layers from the geoserver, i.e., route calculated and parking layer on the OSM map. An algorithm to locate the best location is written. In the above figure we see the layers which are added in sequence on the left side. It has 3 layers loaded i.e.,

- Parking
- Route_calculated
- OpenStreetMap

Once the car plugin is enabled and a mouse click is done on any part of the map the best location of the map is retrieved the green and red box shows the best location for parking based on the previous history of the parking. The green box indicates the first best location for parking since it has more pickup history which is shown in blue color and red box has no or less pickup history which is the second best location for the parking. The first and second best locations here is detected using previous pick up history which is useful in locating the parking slot for the user.

Once the plugin is enabled a list of layers get added onto the map. It is shown as Pickup history2

- Next area
- Pickup history
- Best area
- Currentlocation

The layers get added onto to map from bottom up approach. On a mouse click on the OSM the current location is retrieved and added onto the OSM. Based on current location retrieved best area is calculated from the algorithm based on the pickup history and both are added as layers, for second best location

next area and pickup history² is calculated and is added on the OSM layer as shown in the Figure 4.

V. CONCLUSION

WebGIS- Based solution for parking slot allotment in defoliated area, gives an elegant approach for solving the parking problems for vehicles has been described. This paper provides an implementation of using WebGIS in which spatial data is obtained for the specific area, analysed and best possible solution for vehicle parking is provided. The architectural design is described and implemented using python language. Future enhancement to this implementation would be, to extend the algorithm based on the size, type of the vehicles.

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