Development of a Cloud Based Spatial Information System for Karunagappally Municipality, Kerala, The God's Own Country

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Abstract

Now a day's many applications and modeling fields required the data containing the actual three dimensional data. Most of the applications require Cloud GIS for visualization as well as the analysis in terms of spatial relationship. The present study analyses the essential techniques to realize Cloud GIS visualization were studied. The well-known qgis cloud platform was used for the developmental part of the study. The present study was presented in two parts for the developmental easiness. The first part includes the delineation and preparation of geographical layers of the study area. The second part involves the developmental side using JavaScript.

Keywords: Cloud GIS, SOI, HTML-5, QGIS, DEM.

1 Introduction

Most of the Information System Applications deals with the calculation of the high density data. The Geographical Information System (GIS) technology also deals with high density raster data like satellite images from decades. Due to the technology advancement, more and more spatial data and non-spatial data have been applied in the field of Geoinformatics. The advancement in field instruments and related equipment's the data collection from fields has been increased and plenty of accurate spatial and non-spatial data reached from different data sources. At the same time this trend brought serious problems in data storage, processors and related equipment, especially in the field of GIS systems of physical, logical and location data. So that a single institution or person having minimal processing infrastructure is not capable to do the spatial analysis with this facility due to the low computing power. So that for better processing and sharing computational results and GIS data of dispersed users in different parts of the globe needs one scalable, low cost computing platform such as cloud computing and services are very essential. The cloud computing architecture supports geomatics elements like storage, geospatial modeling, and geo processing. The cloud services is capable to handle the spatial data resources more efficiently, friendly and cost-effective. It is sometimes better than the traditional GIS services**.**

Keywords: Cloud GIS, SOI, Server

2 Review of Literature

The Cloud technology helps to incorporate data services from various data providers and distribute geospatial processing to other processing service providers (Evangalidis, 2014).The Desktop GIS and Cloud Computing integrated with the help of Spatial Cloud Computing (SCC), users can use their spatial data without any need of

fixed operating system or devices (Bediroglu *et al.,* 2014).The database created at a cloud database promote the scientific research and become good base for a powerful decision support tool for the management (Argyrios, 2016).

In India also a large number of studies are reported based on the effectiveness of Geoinformatics in Cloud GIS.'Cloud computing', a term which has become most popular in now a days describe about "the next natural step in the evolution of on-demand information technology services and products". Cloud Computing may be occurred to solve and overcome the challenges in GIS applications (Bhat *et al.,* 2011). The importance of cloud-computing in different sectors for storing large amount of data and GIS as a separate concept in viewing the spatial maps. (Leena *et al.,* 2016). Cloud GIS has bring opportunity to determine watershed zones, generate a huge GIS dataset on cloud and apply GIS analysis, queries at watershed zone on cloud, easier and efficient way to watershed of study area has been indicated on cloud using ready-hosted topology maps (Bediroglu and Colak, 2017).

3 Designs and Implementations of the System

The development of Cloud GIS can be categorized into Two Phases according to the developmental concern. The first one was the preparation and delineation of geographical layers from various sources. The Second phase was the configuration and setup of Cloud services and database Creation of various geographical layers were adopted. The HTML-5 and Java Script were used for the interface creation of the web portal.

3.1 Preparation of Geographical Layers

The present study focusing on Karunagappally Municipality as the study area. The spatial information such as various places and there geographical locations and road networks were depicted from the digital globe high resolution optical imagery from Google Earth. The Survey of India (SOI) Toposheet of 1:50,000 scales surveyed during 1969 to1971 covering the study area of Kollam district was used as base map and as a source of the basic thematic layers such as stream networks, contours, spot heights and watersheds. The ward boundaries delineated from cadastral maps procured from Municipal office. The geology and lineaments vectorised from Geological Survey of India (GSI) map of the study area. The soil types derived from the soil atlas called Bench mark Soils of Kerala surveyed and developed by Soil Survey and Conservation Department Government of Kerala (Fig.1).The contour and spot heights depicted from toposheet has been used to create digital elevation model having twenty meter interval. The slope of the area is derived from this twenty meter Digital Elevation Model (DEM) prepared from the spot heights and contour.

The basic geometric correction of satellite images and toposheets, topology was done in the Quantum GIS (QGIS), premiere open source geo processing software. The Thematic layers are then uploaded and converted into cloud database then it's published as cloud services through qgis cloud plugin.

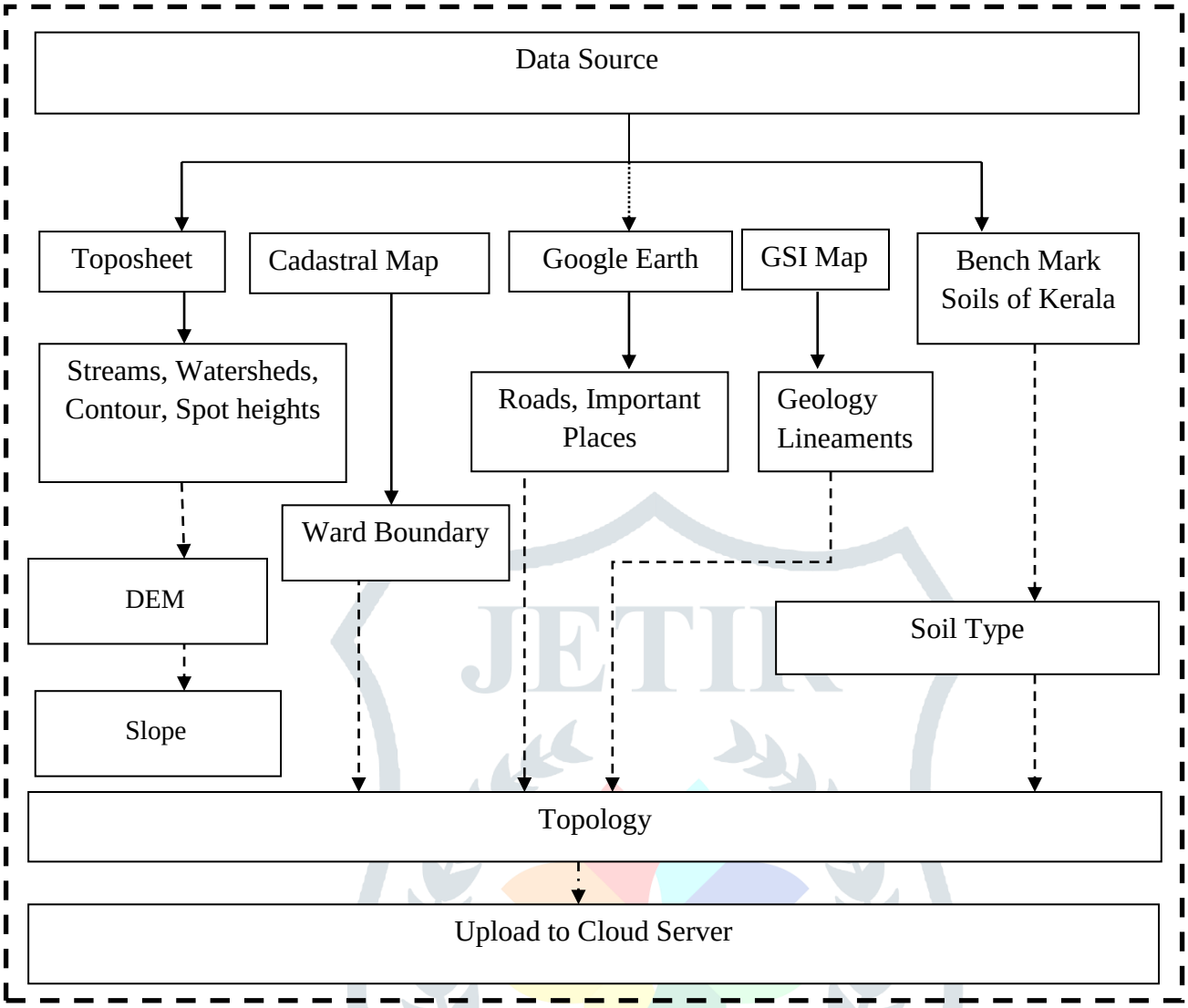

Figure 1 Schematic diagram of Geographic Layer Preparation

4 The Cloud GIS Design Structures and Functions

The ultimate aim of this project is to develop and visualize a Geographical Information System generated map over a cloud system compact with Open Geospatial Consortium (OGC) Compliant. The user could see the maps in a web browser and turn on and off the various layers with user's intervention.

4.1 GIS Cloud Facility

The cloud based GIS has been a recommended approach to the ancient GIS to a global level.This facility providing a better business solution to the global level. This resources can be widely used to the business, assistance, and spatial data easier to be analyzed, authored, and managed. Most of the GIS data may be in large volume. So that the cloud services is fruitful to manage this big data with its large resources.

4.2 GIS Cloud Web Services

The GIS Cloud Web Services is the Combination of GIS, cloud and web technology together to make a better computing paradigm. The Combination of cloud and service based architecture is a promising architecture for the next generation geographical information systems. This architecture is useful to dynamically scalable toGIS, Spatial applications as a web services. This Cloud-Web services capable to handle and hosted large volume of spatial data. The GISCloud web services were designed to provide the hosted spatial data and GIS functionality to integrate the customized GIS applications to perform basic geo-processing tasks, such as map image display, address matching and routing, without maintaining GIS tools or the associated geographical data in the data base.

4.3 Cloud GIS Architecture

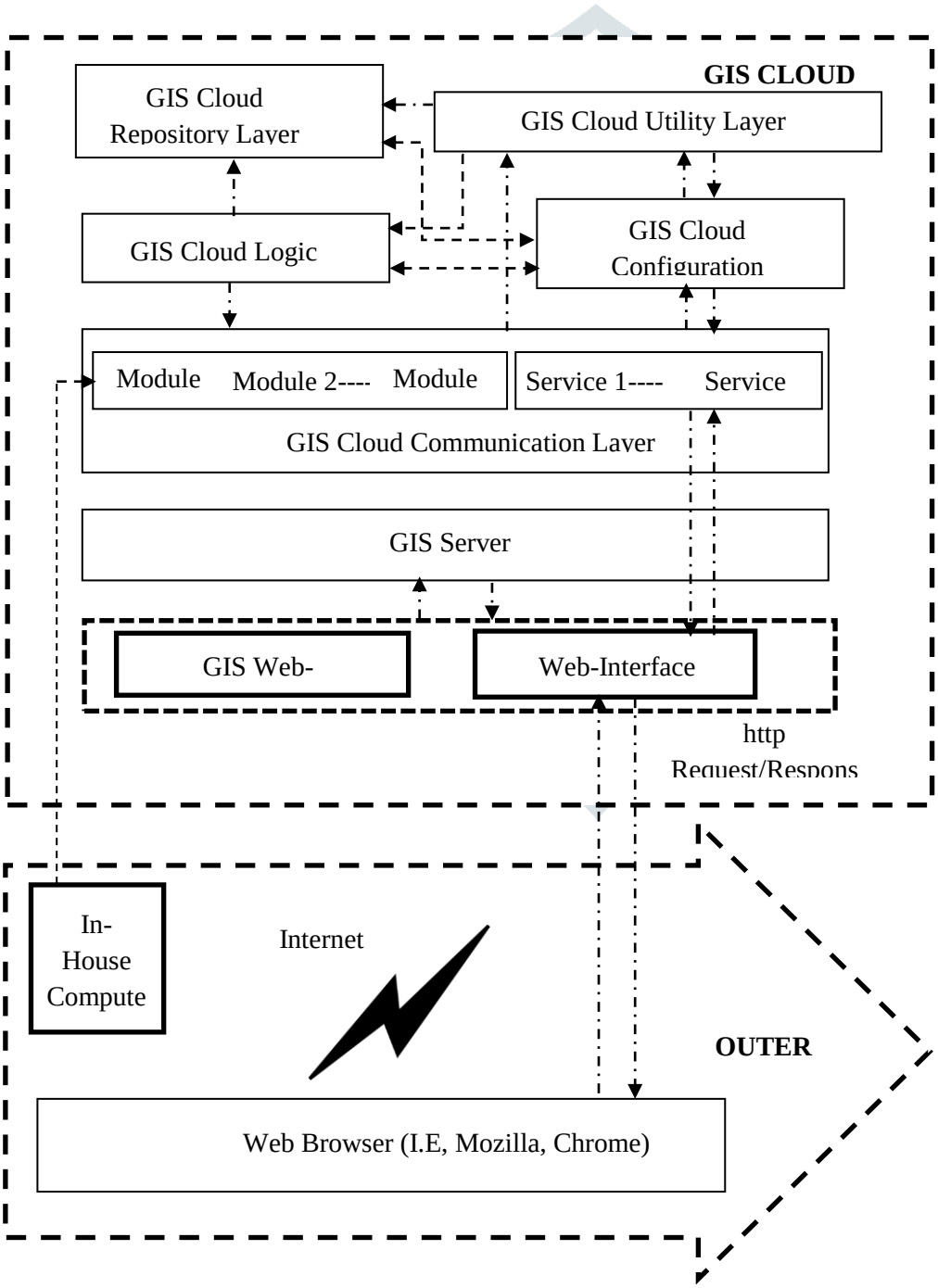

Figure 2 Schematic diagram of Geographic Layer Preparation

The cloud computing is an Information Technology based paradigm that relies on sharing of resources to achieve coherence and economically viable.The Architecture of the Cloud Computing is the configuration of the system that involves local and cloud resources, services, middleware and software, cloud clients and cloud storages, networks and geo-locations. This Architecture is based on the needs of the end-user that the cloud consumer and describes how all these components are arranged and related. The request from the user will connected to GIS server through an interface logic. The cloud system consist of various layer logic likerepository, utility and communication layers, which are all connected through a GIS cloud configuration.

4.4 Capability of GIS Cloud Web Application

The general function of cloud service is a demand one. So that anyone can access when it needs and pay only for the use only. The User can purchase the data storage space according to their application needs. This is also a Multi-variant Architecture so that it can serves its service to many users at a time. The cloud services are personalized services so that the customization is also possible. The basic GIS capability of the web based cloud services are creation, deletion and duplication of new maps, share and publish maps, basic editing operations like add, edit, and delete features,export and import of various data formats. This is also supports web map services including Web Map Service (WMS), Web Coverage Service (WCS) and Web Feature Service (WFS). The web cartographical point of view this services able to visualize the geographical layers which is prepared by the users beautifully. Finally the analysis capability of cloud services is also appreciable. It allows basic geographic analysis like querying, buffering etc…

5 Results and Discussion

The developed Cloud GIS portal successfully visualized and the basic geographical layers such as important places, streams and road networks, soil types, geology, slops, lineaments and ward boundary are successfully created and the present layers are uploaded and properly visualized through Quantum GIS cloud services, a premier open source cloud services. These visualized layers are symbolized and labeled with different attributes. The present work is available at www.qgiscloud.com/sumith/knpy in any web browser as a cloud service.

5.1 Screen Shots

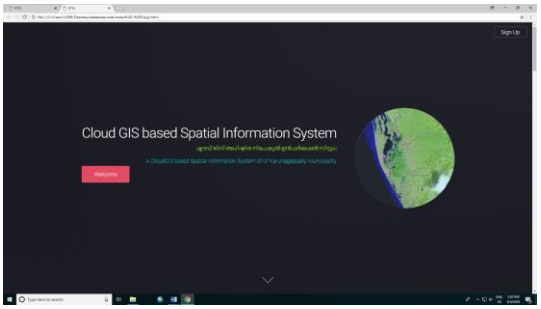

Figure 3 Home Page

Figure 4 Developers Information

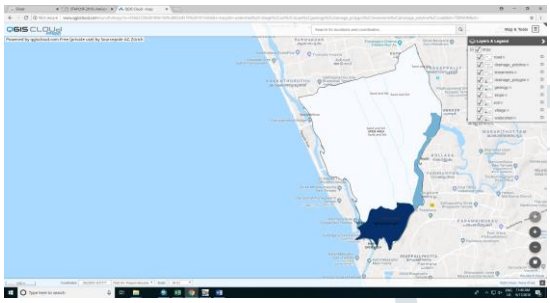

Figure 5 Showing study area

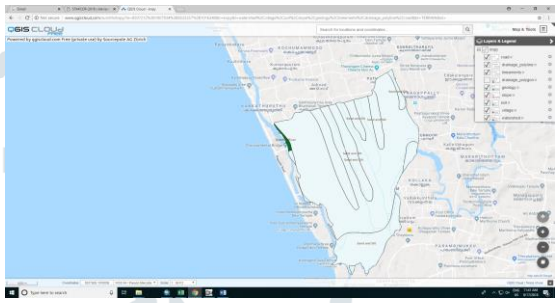

Figure 6 Showing Geology layer

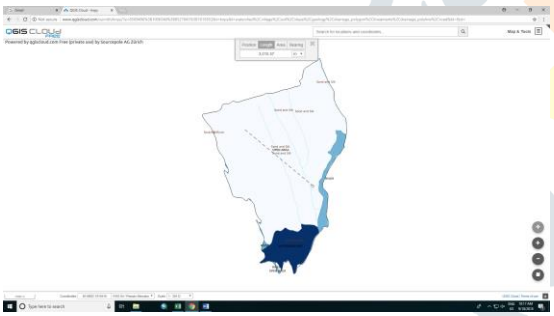

Figure 7 Measuring distance

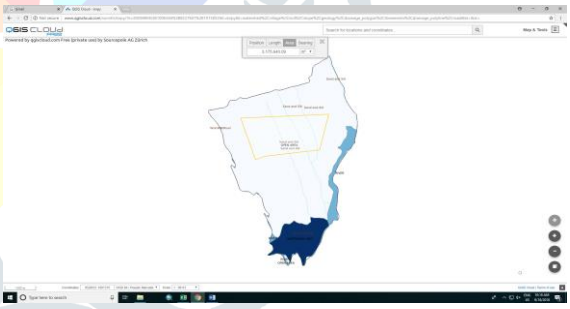

Figure 8 Measuring area

6 Conclusion

This portal capable of sharing the information and geospatial datasets allowing users with limited GIS knowledge to access the information for natural resource management and assists people in their decision- making process. The Geographic Information System and various web related technologies can be efficiently combined as a mechanism to share spatial information freely, openly and easily to the public and authorities.

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