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GEOSPATIAL FRAMEWORK FOR EROSION ZONE IDENTIFICATION ON GEOSPATIAL CLOUD COMPUTING

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Abstract

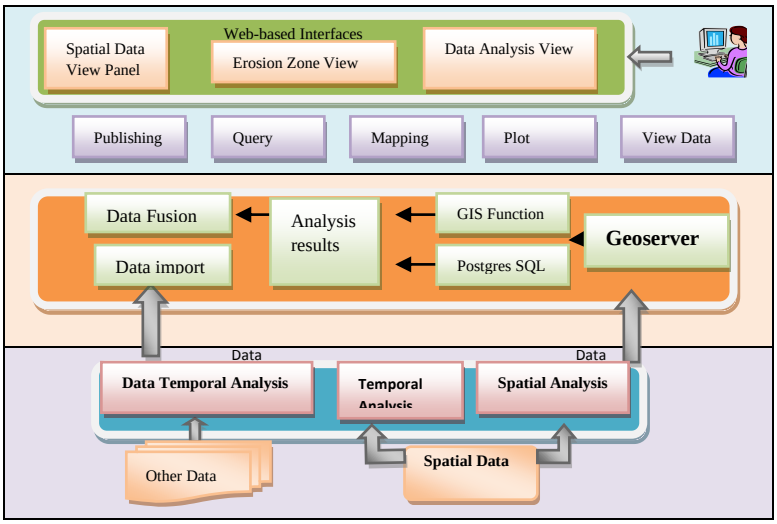
Significant demand from computing resource firms to processing the geographical information (GI) queries has increased. The query helps the users provide the variety of information to serve their needs. Resolving the spatial queries, huge number of heterogeneous data sources along with different computing services is involved. Achieving appropriate results within a certain time frame is essential between those data sources and web services. These services are available on the web and require the specifications of different resource in order to resolve a geospatial query. Cloud infrastructure has been used for scalable resource allocation. In this paper, we have proposed and developed geographical data query processing frame work for erosion zone identification on geospatial cloud using Qgis Software, postgres SQL, Geoserver. The experiment framework shows the efficiency of the proposed framework to resolve spatial queries in timely manner.

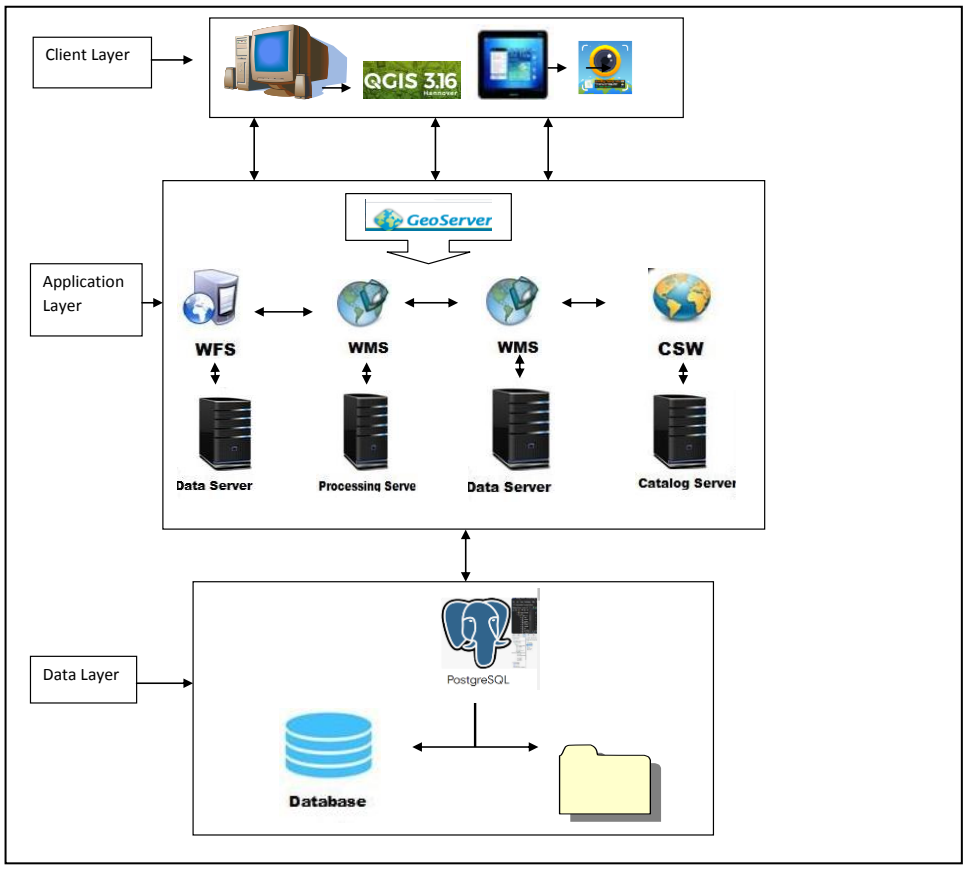
Keywords:
Geospatial Queries, Cloud Computing, Erosion zone, QGIS, Postgres SQL, Geoserver

Introduction:

The Sundarban of India covers an area of 9630 sq. km. covering a total of 19 blocks (six blocks from North 24 Parganas and thirteen blocks from South 24 Parganas) present in the Sundarban. The study area Patharpratima Block is located under the fourteen gram panchayet consisting a total population of 605612 (2011). The geographical extent of the study area extends from 21° 57.600′N to 22° 00′N and 88° 20.400′E to 88° 25.200′E.[1] Patharpratima Block include fourteen gram Panchayets, 87 villages. 33 villages are located in the mainland and 54 villages are located in the Island. The distributaries of the Ganga which place crisscross this land include Saptamukhi, Thakuran, and Mridanga-Bhanga which is surrounded patharpratima block. So, the seasonal flooding, tidal effect and impact of full moon cause embankment breaching in all the river banks area. And its causes serious damage to settlement, agriculture, road, etc. This paper entails a new approach for the prediction of water level in association with flood severity using the ensemble model. Our approach leverages the latest developments in the Internet of Things (IoT) and machine learning for the automated analysis of flood data that might be useful to prevent natural disasters. [2] Resolving the spatial queries, huge number of heterogeneous data sources along with different computing services is involved. Getting appropriate results within a specific time bound, orchestration among those data sources and web services are required. These services are available on the web and require different resource specifications in order to resolve a geospatial query. A cloud infrastructure has been utilized for scalable resource allocation. [3] Geospatial data analysis is an emerging area of research today due to the potential to enable varied location aware services. The existing centralized cloud-based analysis becomes time and computing-intensive for huge amount of geospatial data processing. This paper addresses the challenge of time and power-efficiency in QoS-aware geospatial query resolution. We propose a cloudlet based hierarchical paradigm, namely Geo-Cloudlet, where the cloudlets contain the geospatial data of the districts. [4] In the low lying alluvial soil the farmers are producing mainly rice, jute and many other crops and vegetables. Gradually the pressure of population increased a lot on the agricultural land and the natural hazards like embankment breaching, flood, saline water intrusion and cyclonic impact also increasing day by day. [5]

Proposed Model:





Case studies:

In this work, the spatial data set (River and Erosion Zone) of Patharpratima Block, South 24 pgs, West Bengal, India are considered for generating workflow according to user query. The spatial reference system, EPSG: 32645, is used for displaying various maps.

Query analysis

Query from the user: Find the Erosion zone (top 13) places within Patharpratima, West Bengal, which has Erosion zone and the River 100 Meter.

Query analyses are as:

SELECT area name FROM Patharpratima Block
WHERE Patharpratima Block and River = 'River' and Overlap
(River.shape, Buffer (Erosion Zone.shape, 1)) ORDER BY Patharpratima Block;

In this work, the workflow to solve such type of queries has been developed. After getting the user request, the parser interprets the query string and identifies the relevant geospatial services to solve the query. The predefined workflow model is mapped with the related services and produces a service chain. Then the service will be executed to produce the result.

The steps for generating workflow are as follows:

1) Filter out the lands which have land area at least 50 acres using WFS get Feature service.
2) Create 100 m buffer of each Erosion zone area using WPS Buffer Feature Collection service.
3) Filter out the specific River from the Spatial Data using WFS get Feature service.
4) Make intersection Erosion zone buffer with filtered River using WPS Intersection Feature Collection service.
5) Filter intersected Erosion zone using WPS Intersection Feature Collection service.

From both ascending order lists, user can choose suitable places meeting his requirements

(River and Erosion Zone) from Patharpratima block. From fig. 2, we can observe that parallel flow execute in a distributed system. Cloud computing is appropriate environment for executing these kinds of parallel operations in timely manner. Web services i.e., WFS, WPS and WMS are called several times. If these services are available in different virtual machines, then executions of jobs are done in short time span. However problem may occur to synchronize results.

Experimentation:

To illustrate operational flow, we have taken snapshots of each step of the workflow. These are shown step wise in the figure Fig. 2. Fig. 2a shows all the areas of Patharpratima. Next Fig. 2b shows the filtration result of the Erosion Zone areas of Patharpratima. After creation

of buffer of 100 m, the Erosion Zone looks like the one shown in Fig. 2c. Similarly, River map of Patharpratima is shown in Fig. 3a. The resultant intersection of Fig. 3b. Final resultant Erosion areas are shown in Fig. 3c. Prerequisites: Patharpratima Block spatial databases with Erosion Zone and River information's.

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Service Used

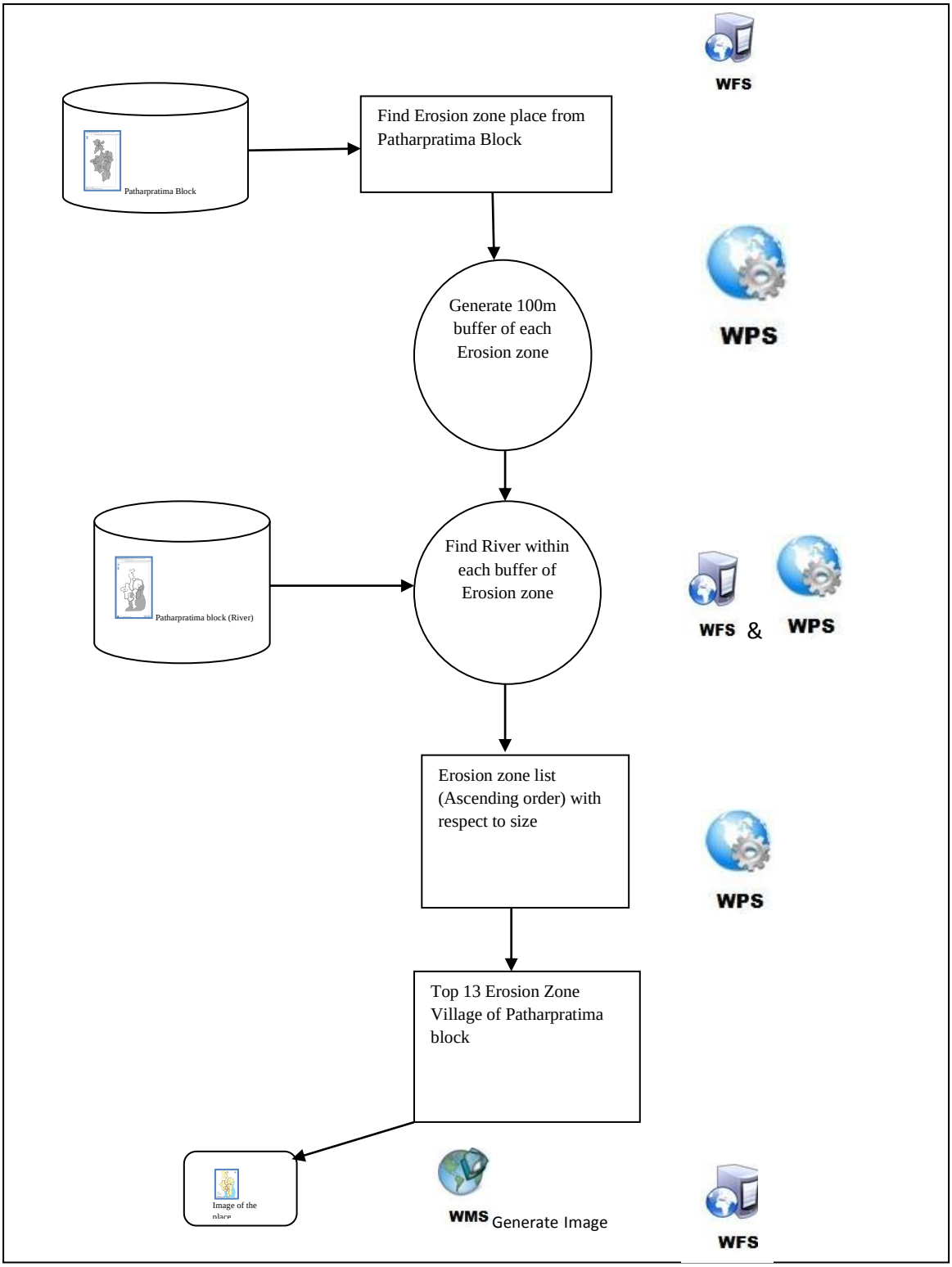
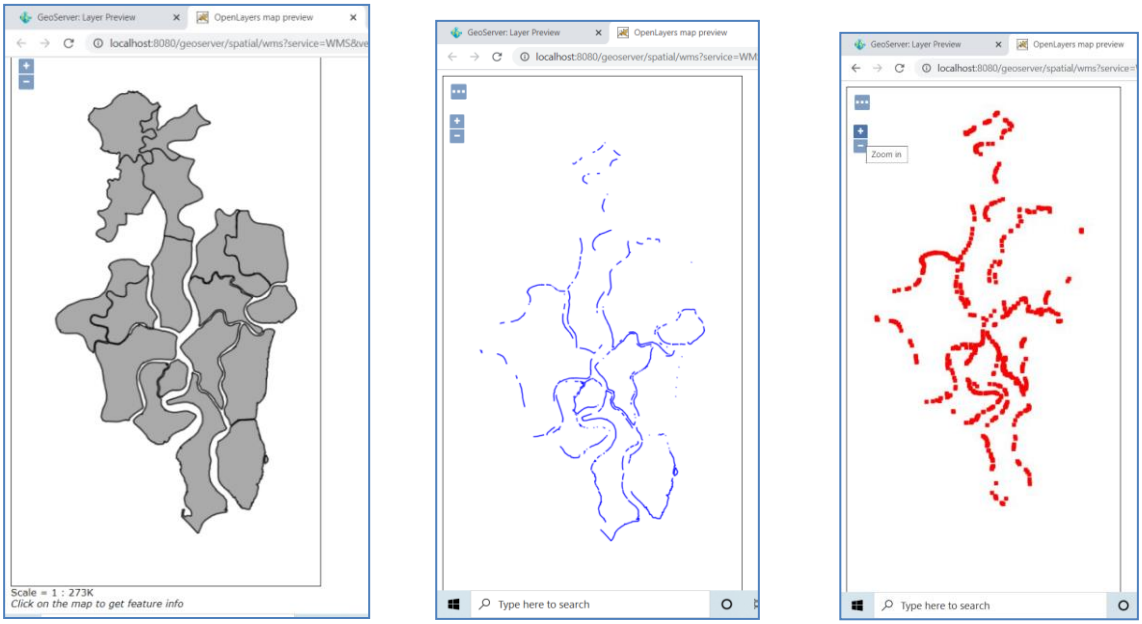


Fig. 1. Workflow of the case study

CONCLUSIONS AND FUTURE WORK

In this paper, we present a geospatial query resolution framework using QGIS, Postgres SQL and Geoserver. The operations like filtration, buffer creation, intersection, display of data are realized which help in efficient resolution of spatial queries. The Postgres SQL abstracts the user query done by feature service, processing service and map service respectively. All the available services are published with metadata in the Geoservice catalog. According to the need of spatial query, synchronization of such services, executing in several virtual machines, is a challenging task.

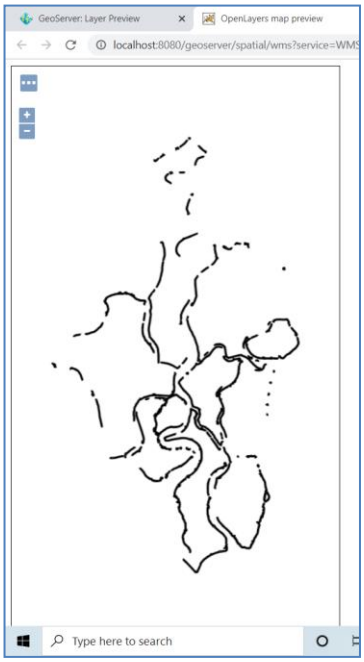
Some challenges in geospatial cloud like implementation of spatial database, scaling of spatial database, policy management among the tenants and the security of Data. The parallel execution of some services in the cloud may decrease the spatial query execution time. The issues related to pricing and quality of the service in the cloud can be explored in future. The cost can be optimized with the use of cost based scheduling by considering the budget of user query. Performance analysis can be carried out in various public cloud platforms like Amazon EC2, Microsoft Windows Azure and Google App Engine.



a.Patharpratima Block b.Erosion Zone of Patharpratima c.Erosion Zone with 100m Buffer

Fig. 2. Spatial query outputs (Study Area: Patharpratima Block, South 24 pgs, West Bengal)

a.Patharpratima River Map



b.Intersection of River and Erosion

Fig. 3. Intersection of River and Erosion Zone

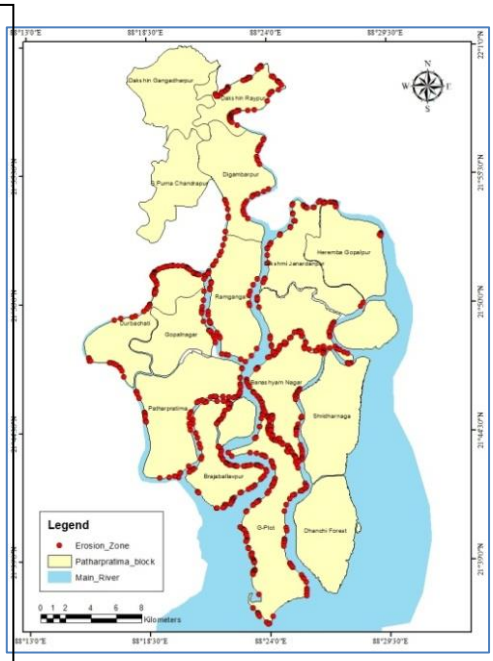


Fig.4. Coastal Erosion Zone of Patharpratima Block

Fig. 5. Some field survey images of Erosion Zone of Patharprtima Block.

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