WEB BASED GIS FOR INFRASTRUCTURE INFORMATION USING GOOGLE EARTH IMAGERY, OPEN SOURCE SOFTWARE AND STANDARDS

Ganesh Borpatra Gohain*†, B.S Mipun ¶, K.K Singh†,
†Agromet Service Cell, India Meteorological Department, Ministry of Earth Sciences, New Delhi
¶North Eastern Hill University, Shillong, Meghalaya

ABSTRACT

Internet provide us the technology to access different levels of information. Geospatial information on the internet is an interactive way for providing information as well as distributing. Web-GIS is the technology platform consisting of different web map service and client-server architecture to enhance information. Internet system provide the service of information collecting, storing, retrieving, analysis and visualizing data. Web-GIS platform provides us with the spatial information for decision making. We have focus on this paper regarding mapping of Infrastructure Information and integrating these information to web based GIS Platform. We have taken North Eastern Hill University (NEHU) campus as our case study. The existing and proposed infrastructures of NEHU, Shillong campus map is used for implementation in which infrastructure layers developed to a web based information system. We have used Google Earth Imagery to create layers using Quantum GIS Software, GeoServer as web GIS server, PostgreSQL/PostGIS as Objet Oriented Relational Database management system (ORDBMS) for interpolate spatial information which can be assessed over the internet efficiently globally. The information contains about the NEHU existing and proposed infrastructures are academic blocks, hostels, administrative block, residential areas, commercial areas etc. The web Based system will help in easy visualization and identification of these layers.

INTRODUCTION

With the development of Technology in Geoinformatics, a new sector of application is the WebGIS and enhancement of web enabled information system. Geographic Information System is a reliable tool in creating and providing rectified spatial information. Web GIS becomes a cheap and easy way of disseminating geospatial data and processing tools (*Aleheikh et al: 2002).* As the growth of the information technology the requirement of much economic, reliable and efficient application software to create spatial information is need of the day.

Geographical Information System is multidiscipline, which can be used by different groups of people depending on their need. Web Based information is an information system which uses internet web technology to provide information and services to end users or other information systems. It is a software application having the purpose of publishing and maintain data.It includes development which will contribute significantly to the fulfillment of any of the objectives of the Spatial strategy or any regional planning guidelines for an area or which would have significant effects or the area of more than one planning authority. Here we have taken North Eastern Hill University (NEHU) Campus as our Object for implementation to web Based GIS information system. We will be integrating infrastructure Layers information in web Based GIS Platform in which we will be using GeoServer as web GIS Server, PostgreSQL/PostGIS as Object Oriented Relational Management System (ORDBMS). These layers will be published through web Based interface instead of using specific software to visualize the layers. Infrastructure is a basic physical and organisational assets needed for the society or services and facilities necessary for an economic function.

A. OBJECTIVES

Our Aim of this paper is to know the implementation of technology behind development of web Bases GIS information system by using open source software and standards. The fast-paced development of GIS has triggered some researchers (*Sui and Goodchild 2001)* to reconsider the fundamental essence of GIS and its social implications. Our objectives will be Mapping the existing and proposed infrastructure of the NEHU, Shillong campus and creating various layers. These layers will be deployed in a web based information system which contains information packages about the NEHU existing and proposed Infrastructure such as academic blocks, hostels, administrative block, residential areas, commercial areas etc. The web Based system will have all this necessary information pertaining to Geographical

location, physical aspects, street maps etc. for easy visualization and identification.

B. STUDY AREA

The study area North Eastern Hill University, Shillong campus is located towards the north-western side of Shillong capital, Meghalaya State and approximately lies between 91°88' E to 91°94' E and 25°63' N to 25°60' N longitudes and latitudes respectively. It covers a geographical area is about 4.95 sq.km.which is shown in **Fig. 1.**
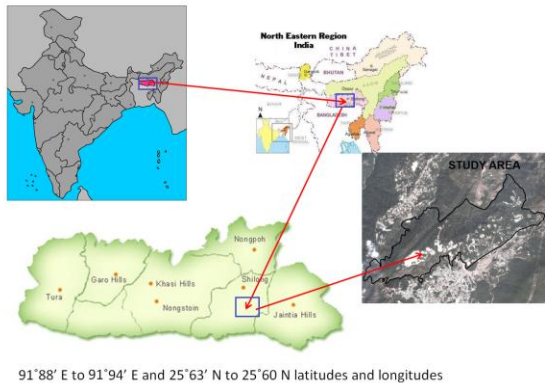
Fig. 1. The regional map of North East India, Meghalaya State and the specific study region are shown by arrow head.

C. METHODOLOGY
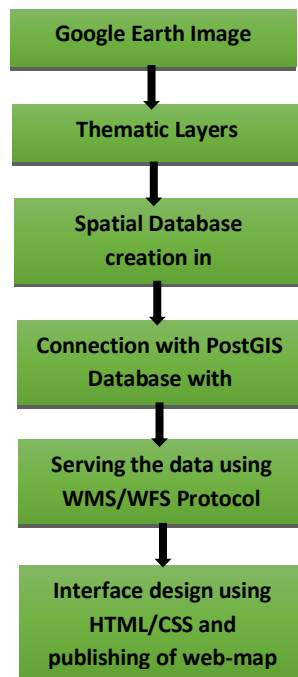
Fig. 2. Flow chart describing the different stages of WebGIS based Data Flow showing the Google Earth Images conversion to Thematic

Layer which is then converted to Spatial Database using PostGIS and serving the Layers using WMS/WFS Protocol through Interface Design

Internet opens a new vision for Geoinformatics which provides dynamic services. With growth of technologies, there is a high rate of growing number of web-GIS application developers which are being develop for different end users. The positive point behind this system is it does not depend on specific software or hardware just we need is a web Browser. Through web we can share any information to different users. We can upgrade and optimize the information irrespective of time.

Here Remote sensing Google earth image is taken to create the thematic layers through on screen digitization using open source GIS software i.e. Quantum GIS. The thematic layers contain information related to hostels, departments, streets etc. These layers are converted to spatial Database in PostgreSQL platform. Then the thematic layers are imported using PostGIS software. After the layers are imported, the PostGIS database is connected to GeoServer. Interface is designed using different technologies like Web designing language HTML and scripting language JavaScript, CSS, and OpenLayers API. Interface design is the user side to get the information. Data serving is done using WMS/WFS protocol. The WMS/WFS protocol acts as a servicing medium that connects between the GeoServer and the web instruction provided by the user. There is a variety of technologies used for developing web-GIS. Database used for storage of data is PostgreSQL which is an open source database. Here PostGIS extension is implemented which allows creating spatial queries. GeoServer produces map image from data stored inside PostgreSQL database, while PostGIS has the spatial reference system with their geometric features such as surface, length and others. HTML interface was created where all objects controlling forms and JavaScript makes systems more reliable and flexible. The frontend is the web Based Information system and in the backend it is the Geoserver through which maps are published by extracting the information stored in the PostgreSQL Database. The Web Based GIS is evolved from different web maps and client-server architecture to distribute.

D. RESULT

The thematic layers are created from our study area. Generated spatial layers are processed and serviced through Geoserver. These Layers overlays on top of Google maps. The source for Google imagery maps is the internet. As we have assigned correct spatial reference and Projection w.r.t Google Map and styled all these layers having transparency features, it will overlays with the same spatial features as in the Google

The Overlays are shown below.
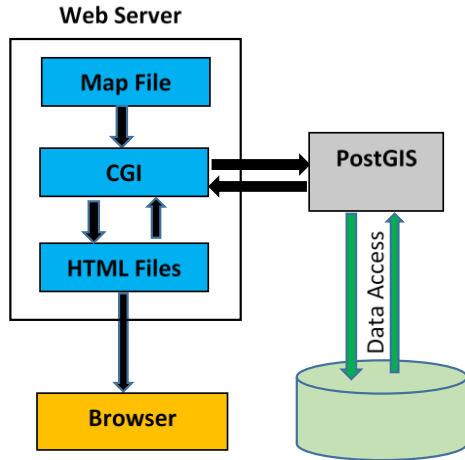
Fig. 3. Schematic Diagram for Working Process to visualized Web based GIS Layer Maps involving the web Server to Request and Retrieve of Layer data from Database to web Server and displaying it in Web Browser as GIS Layer Maps
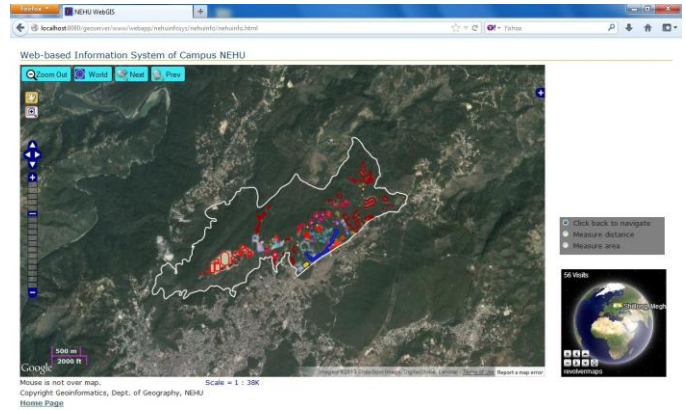
map. This proves that out methodology architecture is found to be correct and hence we can implement these model and can be modified for our future references. This methodology can be used for any area for generating web-enabled information system. Just we need to change the database name and spatial references in web Based Application codes.
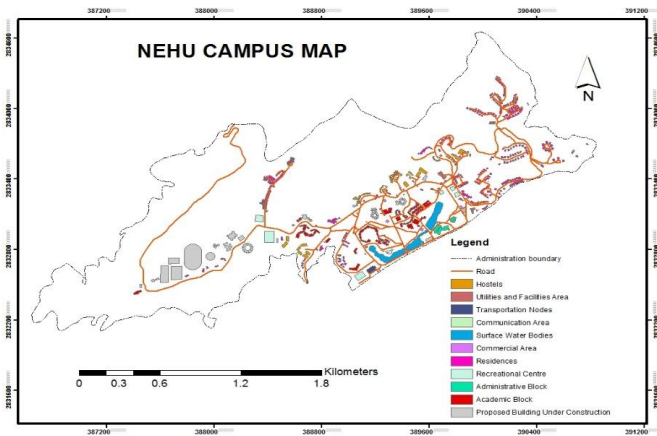

Fig. 4. Map Showing the Thematic Layer of North Eastern Hill University Campus having Roads, Hostels, Utilities and Facilities Area, Transportation Nodes, Communicational Area, Surface Water Bodies, Commercial Area, Residence, Recreational Centre, Administrative Block, Academic Block and Newly Construction of Buildings.

The thematic layer generated will overlap with Google Satellite map, Google openstreet map, Google Physical map, Google street map and Google Hybrid map.
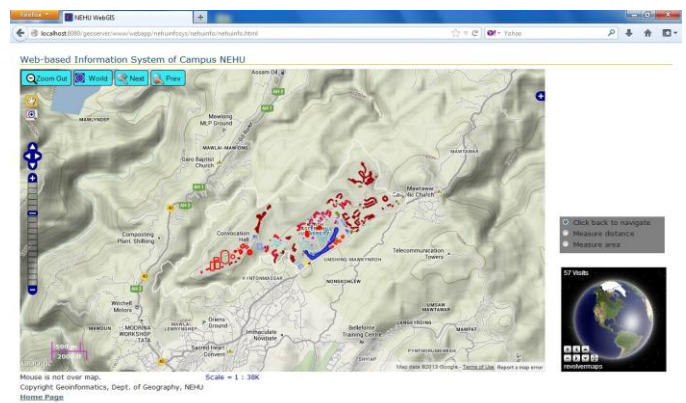

Fig. 5. Interface showing the Thematic Layers of NEHU campus overlaying with the Google Satellite Map Image
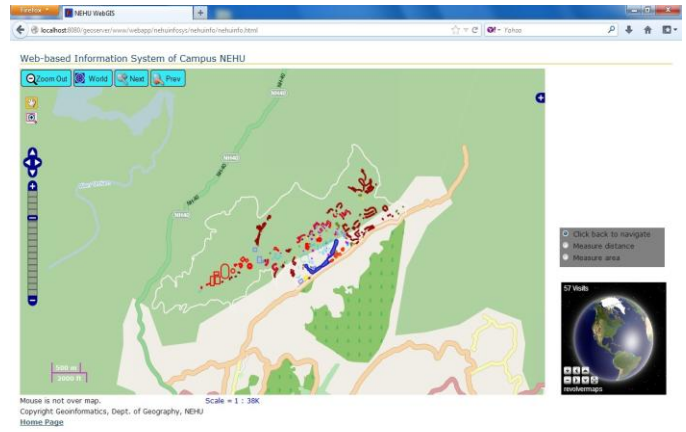
Fig. 6. Interface showing the Thematic Layers of NEHU campus overlaying with the Google openstreet Map Image

Fig. 7. Interface showing the Thematic Layers of NEHU campus overlaying with the Google Physical Map Image

Fig. 8. Interface showing the Thematic Layers of NEHU campus overlaying with the Google street Map Image

Fig. 9. Interface showing the Thematic Layers of NEHU Campus overlaying with the Google Hybrid Map Image

Fig. 10. Interface showing the Thematic Layers of NEHU campus in web Based GIS Platform, Interface is designed having different tools which include window zoom in and out button, preview back and Next button, PAN button, select Zoom in bottom, Map scale, Thematic layer selection menu, Base Layer selection menu Tools for measuring the distance and area and also location Identifier from where the web application is being used

The web Based interface designed consists of different components which include overlays option for addition of spatial layers and Base maps option for flipping of different Google Maps. Toolbar with required functionalities includes zooming in and out, panning the image, previous and next bottom for undo and redo option. Toolbar for measuring the distance from one features to other and also area. Map Scale and location co-ordinates includes in the interface along with Popup window showing the brief details when any spatial feature is clicked.
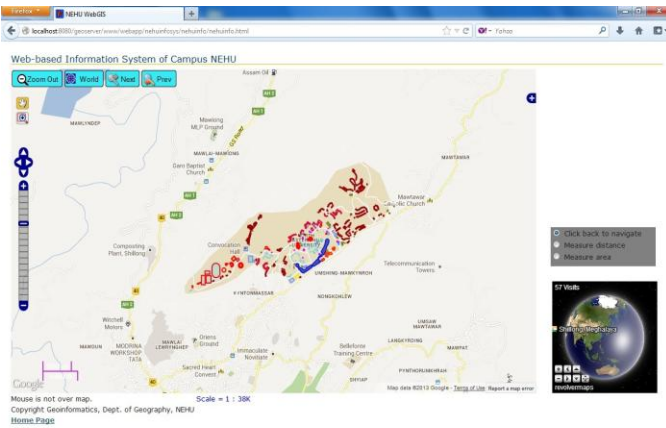
E. CONCLUSION

The web based Information system has various bundle of layer integrated with GeoServer. Every users can access the information efficiently in a common platform and can visualize the same information simultaneously. To implement the web based GIS architecture successfully we have taken the case studies of NEHU Campus Infrastructure. The interface developed is cost effective approach. GeoServer has different packages of inbuilt basic styles, and we can add and integrate any number of new styles to it. It is possible to change any layer's associated style at any time by just accessing the Web Administration Interface in the browser. Popular technology which is developing is the use of JAVA based concepts. Web-GIS is a relatively recent technology which is developing with time. GeoServer intensify the quality and presentation of their own map and is at further support for WFS, WMS and other OGS specification. Our developed framework can skill further improvement and more user friendly for convenient use for different type of map application services for any location in easy, openly accessible, flexible, and attractive to fulfill any user's requirements.
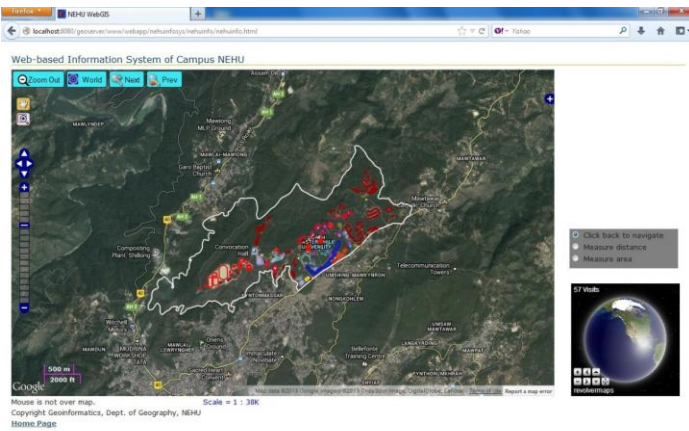
F. ACKNOWLEDGEMENT

G. REFERENCES

[1] Alesheikh, A. A. (2002) Web GIS: Technologies and Its Applications
http://www.isprs.org/proceedings/XXXIV/part4/pdfpapers/42 2.pdf
[2] Burdziej, J. (2010) Using Web Map Service (WMS) With Styled Layer Descriptor (SLD) For Creating Dynamic and User-Oriented Maps.

http://icaci.org/files/documents/ICC_proceedings/ICC2011/Oral%20Presentations%20PDF/E2-Web%20mapping/CO-434.pdf.

[3] Chaowei (Phil) Yang, Davidw.Wong, Ruixinyang. Performance-improving techniques in Web-based GIS. International Journal of Geographical Information Science.Vol.19, No. 3, March 2005, 319–342
http://cpgis.gmu.edu/homepage/papers/webgis-performance-ijgis-2005.pdf

[4] Doyle, A. (1999) Web Map Server Interface Specification. OpenGIS Project Document 99-077r1
URL: http://www.opengis.org

[5] Sheikh Mujabar, P. (2010) Web based coastal GIS for southern coastal tamilnadu by using ArcIMS server.
http://www.ipublishing.co.in/jggsvol1no12010/EIJGGS2030.pdf