Browser Based Viewshed Analysis
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Abstract— To do research and development for generating viewshed analysis on 3D Earth terrain. 3D capabilities to be realized directly in a supported web browser without any need for an additional plug-in or extension. A viewshed is an area that is visible from a specific location. A viewshed analysis on 3D Earth terrain will be helpful in understanding and preparing for locate communication towers or to determine the view from a road. In this paper, a study is undertaken to find an approach for viewshed analysis in client-server environment. This paper discusses technologies like WebGL, HTML5, JSP, CesiumJS and Apache Tomcat for achieving 3D viewshed analysis. HTML5 is an open standard format and provides common platform for application to be developed and used on the web. WebGL is an extension of HTML5, which is now widely used for developing web applications requiring 3D visualization.

Key words: HTML5, CESIUMJS, JSP, WEBGL, DEM

I. INTRODUCTION

A viewshed is an area that is visible from a specific location. The viewshed analysis uses the elevation value of each cell of the Digital Elevation Model (DEM) to determine visibility to or from a particular cell. The location of this particular cell varies depending on the needs of the analysis. For example, a Viewshed analysis is commonly used to locate communication towers or determining the view from a road. The 3D viewshed analysis will be helpful in understanding and preparing for emergency scenarios in case of disasters. It could be used to estimate the impact of the addition of a large building. The analysis would show all the areas from which the building could be seen as well as any views that would be obscured from any particular location. Viewshed analysis is also used to locate fire observation stations in mountain areas (Lee and Stucky, 1998). This allows the stations to be placed so that the entire forest can be observed for possible fires.

Viewshed analysis is a common function of most Geographic Information System (GIS) software, like Google Earth, ESRI ArcGIS, Intergraph ERDAS Imagine, etc. These software are standalone in nature and needs to be installed in a computer.

In this project an attempt is being made to carry out viewshed analysis in client server mode, i.e. to develop a browser based web application. HTML5 is an open standard format and provides common platform for application to be developed and used on the web. WebGL is an extension of HTML5, which is now widely used for developing web applications requiring 3D visualization. In this study WebGL, HTML5, JSP and CesiumJS will be used to achieve viewshed analysis.

With the help of 3D and dynamic contents, the objects can be visualized and interpreted in a much better way than before. Applying such approach, 3D capabilities can now be realized directly in a supported browser without any need for additional plug-in or extension. Another benefit of WebGL over other technologies is that it utilizes hardware graphics card memory for displaying and performing operations on 3D contents and hence, it provides hardware accelerated 3D functionality on the web.

II. LITERATURE

Currently Viewshed analysis are available in commercial standalone software like ESRI ArcGIS, Intergraph ERDAS Imagine, Rolta Geomatica etc. These Existing 3D visualization solutions work with only certain browsers or with additional browser plug-in installed. This limitation can be overcome by assembling the visualization using WebGL and HTML5. Esri’s ArcGIS is a geographic information system (GIS) for working with maps and geographic information. It is used for: creating and using maps; compiling geographic data; analyzing mapped information; sharing and discovering geographic information; using maps and geographic information in a range of applications; and managing geographic information in a database. The system provides an infrastructure for making maps and geographic information available throughout an organization, across a community, and openly on the Web. ERDAS IMAGINE is a remote sensing application with raster editor abilities designed by ERDAS for geospatial applications. ERDAS IMAGINE is aimed primarily at geospatial raster data processing and allows the user to prepare, display and enhance digital images for mapping use in geographic information system (GIS) or in computer-aided design (CAD) software. In the existing systems we have to purchase extra plugins also. In this proposed study Client server based application based on open source approach, will be a value addition to replace the age old standalone applications and also it eliminates third party vendor dependencies. A viewshed is created from a DEM by using an algorithm that estimates the difference of elevation from one cell (the viewpoint cell) to the next (the target cell).

III. PROPOSED SYSTEM

In this study a client server application will be developed using WebGL, HTML5, JSP, CesiumJS and Apache Tomcat. And in this on google earth we are creating multiple objects at a time, and in that objects we capturing the images whatever client wants. Those images also we are going to show in 3D view by using above open source languages.

A. WebGL

WebGL (Web Graphics Library) is a JavaScript API for rendering interactive 3D computer graphics and 2D graphics within any compatible web browser without the use of plug-ins. WebGL is integrated completely into all the web standards of the browser allowing GPU accelerated usage of physics and image processing and effects as part of the web
page canvas. WebGL elements can be mixed with other HTML elements and composited with other parts of the page or page background. WebGL programs consist of control code written in JavaScript and shader code that is executed on a computer’s Graphics Processing Unit (GPU). It uses the HTML5 canvas element and is accessed using Document Object Model interfaces. Automatic Memory Management is provided as part of the Javascript language. WebGL does not have the fixed-function APIs introduced in OpenGL 1.0 and deprecated in OpenGL 3.0. This functionality can instead be provided by the user in the JavaScript code space. Its containing many desktop browsers Google Chrome, Mozilla Firefox, Safari, Opera, Internet Explorer. And which are the mobiles having WebGL capabilities that mobiles can access this browser. The WebGL API may be too tedious to use directly without some utility libraries, which for example set up typical view transformation shaders (e.g. for view frustum). Loading scene graphs and 3D objects in the popular industry formats is also not directly provided for. JavaScript libraries have been built (or sometimes ported to WebGL) to provide the additional functionality. Using WebGL can access GPU without any plugins.

**Fig. 1: WebGL System Structure Diagram**

**B. HTML5**

HTML5 is a core technology markup language of the Internet used for structuring and presenting content for the World Wide Web. HTML5 performs audio and video by using a unified language, data model and rules, which enables developers to integrate audio and video content and other content of web page easily, and provides a new approach for multimedia applications in the Internet. The application of the new features in HTML5 strengthens the performance properties of the page and added some other applications like the local database application, which make the Internet interactive content more and more rich, and greatly enhance the user experience.

**C. JSP**

Java Server Pages (JSP) is a technology that helps software developers create dynamically generated web pages based on HTML/XML, or other document types.

**D. Cesium**

Cesium is a JavaScript library for creating 3D globes and 2D maps in a web browser without a plugin. It uses WebGL for hardware-accelerated graphics, and is cross-platform, cross-browser, and tuned or dynamic-data visualization. Cesium is open source under the Apache.

**Fig. 2: JSP Model Architecture**

**E. Apache Tomcat**

Tomcat is an open source web server developed by Apache Group. Apache Tomcat is the servlet container that is used in the official Reference Implementation for the Java Servlet and JavaServer Pages technologies. The Java Servlet and JavaServer Pages specifications are developed by Sun under the Java Community Process. Web Servers like Apache Tomcat support only web components while an application server supports web components as well as business components (BEAs Weblogic, is one of the popular application server). To develop a web application with jsp/servlet install any web server like JRun, Tomcat etc to run your application.

**Fig. 3: Cesium Browser**
IV. ALGORITHM

- Get the current user location (say center point) on the google earth cessi##.js by giving current address.
- Select the shape and area covered from current location as a center point.
- Calculate the latitude and longitude on a plane surface.
- Use: + for N Lat or E Long - for S Lat or W Long.
- Example: +40.689060 - 74.044636
- Example: +34 40 50.12 for 34N 40’ 50.12”
- Also put here lati/longi part from home.jsp
- Color the surface area with default color.
- Click on anywhere within the covered area for facilitation center in 3D view.
- Paint the items over the surface by using DEM model.

V. DEM

A digital elevation model (DEM) is a digital model or 3D representation of a terrain's surface - commonly for a planet (including Earth), moon, or asteroid - created from terrain elevation data. Using the height values in DEM we can determine the viewed/shed from a particular cell. The location of this particular cell can be dynamically selected by the user. Also height from which analysis is to be done and view angles can be dynamically fetched from the user.

Surfaces represented by a Digital Surface Model include buildings and other objects. Digital Terrain Models represent the bare ground.

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