



Survey And Analysis Of Rendering Realtime 3D Object On Cross-Browser & Cross-Platform Using Web-GL

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Abstract: This paper based/focus on 3 Dimension Web Object rendering in real time. Which present browser based visualization of 3D (3 Dimension) object? The paper contains analysis of 3D object rendering in real time. The 3D object and its web based application is started couple years ago. We would like to thanks of great conversion of the runtime environment browsers for their adaptive 3D shape modeling environment design which support platform independencies. As well as thanks for Web Graphics Library which extends and allow GPU-accelerated usage of physics and image processing. But delivering 3D objects model for the various clients with their various platform is making difficult for trustworthy object or model. Also it's hard to maintain same models parameter with this vast available environment and platform. Now a day's screen size is main issue for generating graphics in real time each new devices come with their new screen dimensions. Also devices has different processing power capacity. It becomes difficult to generate graphics for this devices. As well as it becomes more difficult when we trying to generate or trying to rendering heterogeneous volumes of 3D Graphics in real time. In this paper we focus on rendering technique in real time so that we can serve our users with various platforms with less amount of resources. our study is relies on the different kinds of 3D rendering techniques which allow as real time results for any low level processing power machine such as handheld devices.

Index Terms – 3D Object, Web-GL, Java Script Engine, 3D Graphics, Web Browser, GPU, Parallel processing.

I. INTRODUCTION

Now a days in technology provides a way to access an internet in very cheap price. With these advancement the size of processor also decreases and this advancement made direct impact on their users. In this part are not innovators or creator of this advancement they just an end-user who wants to use this technology advancement and get their work done in very efficiently. One of their advancement is a graphics. Many game are required high end processing power to visualize, and normal computer CPU is not enough to provide such a high computational power to visualize such a graphics scene. As we know one of such graphic is a 3D image which required high computational power. As we know in normal color image are being made by RGB colors which is 16 billion which is 24 bit wide to storing 1 pixel of amount we required 24 bit wide space if image is 1024*720 wide then we required around 16 Mega Bits storage to store image in main memory and processed by processor. Now a day's image color technology advancement is increases and it support 32 billion color combination therefore it required 32 bit of storage to load 1 pixel on screen it becomes around 22 Mega Bits storage to store image in main memory and processed via processor. The normal processor can be handle this image processing when the image based in 2D axis like based on X any Y coordinates. When the image is displaying on screen processor reads its file data based on file header information like whether it's RGB color scheme or SRGB color scheme. Then it's decided whether we have to read 3 byte or 4 byte data to generate color for a single pixel. Thus how 2D image can render on display to visualize. But whereas creating a web-based collaborative 3D shape model required some major resources such as high speed network, for continuous rendering at least 2 GHZ processor, Java Script supported web browser enabling with Web-GL support and modeling. The modeling is the core of the environment, through which we required to model 3D shapes in system.

The most well-known method of representing 3D model is Boundary Representation i.e. BRep known as polygonal mesh. The Boundary Representation is mathematical precise model and it hold 3D shape in the form of vertices and faces. Also the Boundary Representation (BRep) has ability to represent complex volumes [1].

As we consider almost all web-based objects or an modeling systems are basically depends on polygon's or polygon mesh's using this they can achieve quick rendering via utilization of less hardware resources.

So in this paper we address the issues of rendering complex objects by applying various rendering approaches and techniques in real-time using web-browsers and Web-GL. The paper first explains and explore what actually is 3D models then we explores various rendering techniques based on 3D models [2]. We focus on complex rendering objects in real-time with 3D modeling and rendering environment. In this paper discusses supporting tools and related environment

II. 3D OBJECT AND IT'S MODELING ENVIRONMENT WITH WEB-GL

We all know since internet bring advancement in it with Web2.0 era, the browser has become an very important tool for people to obtain the latest information through Internet with this web engineering combined with 3D visualization and trying to provide new way to convey information to its users through internet [3]. To bring such advancement in technology mostly used JAVA, C and XML like programming and data interchange formatters to meet the needs of multiprogramming and multiprocessing which implemented 3D graphics Interface, Web-GL.

Web-GL stands for a Web Graphics Library, it's a new API which is based on the OpenGL ES 2.0 that combines HTML5 with Java Script and provides accelerated rendering of canvas element inside in HTML5 with the help with OpenGL Programming Language. Below is a Figure 1 which represents all connection of above technologies.

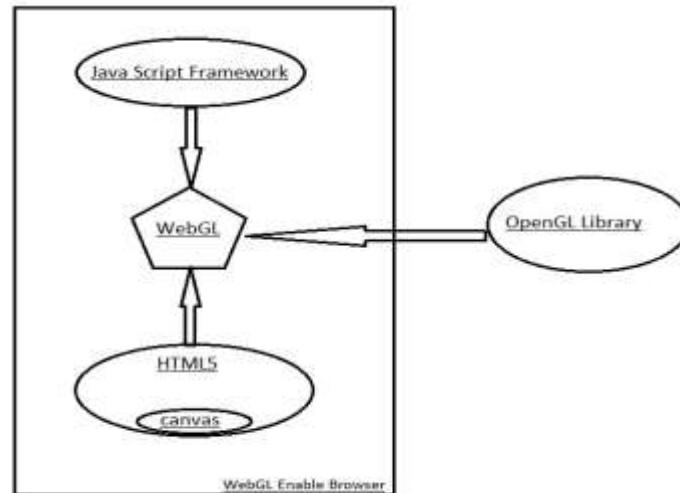


Fig. 1. Basic Web-GL architecture and work flow

2.1 Java Script Framework:

A java script framework is known as application framework which is generated or written using help of java script programming language. This java script framework is different form Java Script library and library's control flow. Normally Java Script library offers its functions along with its code whereas Java Script framework is define entire application design. In this framework some framework is also uses a model view paradigm or some uses model view controller paradigm designed to keep segregate application functionality code, to improve code quality and code maintainability. Such as angular js, react js etc.

Couple of time java script framework very useful when we are dealing with GUI kind of real time graphics operations the one of main reasons for an beginner is that the java script has strong community and browser have built is extension so that beginner can help them self's via debugging the their things. So now we can say that Java Script framework is a tool so that we can leverage to develop advanced web application especially if the application is related with a GUL specific.

Also the graphics programming in browser is directly based on Web-GL i.e. web graphics library. And Web-GL is developed or Web-GL has based of OpenGL i.e. Open Graphics Library, thus is require user to have deep knowledge and understanding of OpenGL programming language for an 3D design as well as native API's of Web-GL. To having such deep knowledge and understanding is quite more difficult thus this becomes an inefficient to develop and design. Therefore Java Script framework makes such task a little bit easier. As if we make some changes in such framework we can directly display three-dimensional images in the browser pages.

2.2 Web-GL (Web Graphics Library):

Web-GL stands for Web Graphics Library is a developed and based on Java Script application programming interface specially used for running in Graphics related stubs inside a cross platform web browsers. Until few years ago interactive 3D graphics have poor availability on World Wide Web. Still now a day's even have a good processor with better computational power and high-performance hardware they have not been utilized effective web-based interaction.4 Web-GL element is mixed with inside the HTML elements and run with other part in the web page or web page background. The Web-GL has control code which is written in Java Script and shader code that is written in OpenGL ES Shading Language i.e. (GLSL ES). The OpenGL ES is a programming language which is pretty similar to a C or C++ programming language and this executed on computers GPU i.e. Graphics processing unit. Due to cross platform Web-GL is platform independent and it is easily adopted with any platform browsers.

The Web-GL based on OpenGL and now currently stable version is 2.0 which is already based on OpenGL ES3.0 which made guaranteed and give assurance of many optional and required functions of previous builds. The latest build of Web-GL 2.0 contains Automatic memory management is provided implicitly by Java Script also the OpenGL ES 2.0 like Web-GL also do not have the fixed-function API's, and if required it has been implemented by the end developer by providing shader code and configuration and itself developer has to configure the data binding in java script.

2.3 Web Browser:

A web browser is referred as software which created using programming language which give us ability access the information on the world wide web i.e. WWW when its user required.

The web browser is a software which retrieves a necessary content form web server which located remotely on internet and then display the retrieved data on front of screen on organize manner [5].

Web browsers are used on a range of device including Desktop, laptop, tablets and smart phones. As a survey in year 2019, an estimated 4.3 billion people used or using a web browser some of using it in their Desktop some of using it in their smart phones and etc. The most used browser is Google Chrome and it has around 63.59% global market share on all device followed by safari 19% and so on [5].

The purpose of web browser is to fetch information and data from world wide web and display this information on users display with an appropriate manner. In this case displaying the information is known as displaying the web GUI on user display doesn't matter whether it is 2D or 3 dimension GUI according to received script from web server the web browser creates or render GUI using GUI API ex. WebGL and shown to the user.

Normally the most used web browser is Firefox, chrome, IE9, 10 and for apple products Safari are the default browsers of various operating systems. This entire browser rendering complex GUI requires the WebGL i.e. Web graphics library. The WebGL2.0 is first supported by Firefox 51 as well as the chrome 56 is first supported desktop platform also in android devices which using chrome this feature can be enable or disable via navigating to about: flags, finding an entry for "Web-GL 2.0" and changing the setting from "Default" to "Enabled". Although WebGL 1.0 is supported in the stable releases of most major browsers on both including mobile and desktop platform. The chrome, Firefox, Internet Explorer, Opera, and safari are all well known to have good WebGL support on both mobile and desktop platform browsers.

2.4 HTML:

The HTML known as Hyper Text Markup Language. It is formal specification of displaying web page inside a browser in the form of frame, tags and paragraphs. HTML contains 2 major parts Head and Body, whereas head representing an web page information and body used to provide web page specific content [3].

The latest version of HTML is HTML 5. It is fifth major update which announced by the World Wide Web consortium known as W3C in the year of 2014. In this update the Web Hypertext Application Technology working Group also known as WHATWG gives the major cooperation. With this HTML5 added new standard features like video playback, drag-and-drop which previously dependent on third party plug-ins such as adobe flash, MS silver light etc. The among all new features HTML5 contains server-sent events and canvas which support events which flow from web server towards the web browser and supports two dimensional drawing surface that can program with Java Script along with audio video control respectively. So that developer can embed audio or video on web page to increase user interface.

HTML is designed as much as possible to be backward compatible with existing web browsers thus it can support previous as well as current GUI library's like WebGL. Also it is suggested to detect support for individual HTML5 features using a few lines of Java Script.

2.5 Web Service:

The term Web service is states that it's an standardized way for integrating web application using JSON(java script object notation), SOAP(Simple object access notation) etc., A web service is nothing but an offering a service from one electronic device to the another electronic device using a medium of world wide web. So the transmitting a data from web server to web browser required a tool which uses an internet to transmit a data from web server to all interested users. So for this purpose we required a web service, this service enable to communicate on the base of Ajax calls which enable to send request to the URL request where service is placed. The response in service contains time instant numerical data [6].

III. 3D REAL TIME LOAD OF DETAIL

3-dimension object has very detail object even while zooming or zoom outing. The object detailing is a major part of object construction where hardware performance is compromise through hierarchical details. Thus here user feels significantly loss of effect. And improve the frame rate of the real time display, it means that users cannot see objects in the distance clearly, and they do not pay attention to 3D object. So as based on this observation we can reduced the rendering accuracy and the accuracy of object in the form of distance [7].

Based on above observation we understand that in rendering scene with depth of field the object which rendering accuracy or object accuracy can be reduced for the high depth model.

Generally load of detail into discrete and continues load of detail. Discrete load of detail which goes through the preprocessing stage after this stage it converts into fine-grained models. After that each model pulled by display system and load on display model correspondingly with appropriate level by detecting Load of detail. This method by designed and proposed by Clark [7]. In the other hand continues load of detail calculate the hierarchical model at runtime so which needed based on the previous or next level to solve the problem of granularity in the discrete load of detail. The major problem with discrete load of detail is in some critical situation it gives the result in the use of too many or a too few grids. But this problem can be improve by adding more discrete load of details, but adding the more Load of detail increases an memory consumption. Thus some time most of model has become difficult to generate in the real time [7].

3.1 3D Modeling in Health Science

Three dimension object are majorly used in health science i.e. in medical instruments ex. CT scanning and MRI scanning. Data which scans through this machines are in the form of series it can called separate slice also. This slice of data is in 2D form known as 2D slice. The 3D dataset normally consist around like a hundreds of 2D slice. This becomes a huge data to process at real time on single system. With normal processor [8].

The data which produced by medical instruments is very huge in some cases to deal with this data mainly used two approaches for analyzing and reconstructing kind of data and this approaches commonly known as an surface rendering and volume rendering. When data is viewed on the display in the form of GUI surface rendering is commonly used that is in surface rendering, it only shows an interested surface information of object. Also in surface rendering required less amount of storage because surface rendering uses fewer element to render. In other hands come volume rendering the name suggest it related to the volume of data means more data required extra storage space. In volume rendering shows both inner and outer information of objects. Thus data structure which required the volume rendering is more critical and complex then surface rendering and it consist of far more elements. So as we consider in the form of reconstruction speed of three dimensional objects, surface rendering has far more advantage then volume rendering technique. As we know the three dimensional object constructions required extra hardware resources and we have less limit of hardware condition, the surface rendering becomes more efficient rendering then volume rendering. Also well know famous Marching Cubes algorithm of three dimension object construction is based on surface rendering which makes an important effect on the surface reconstruction.

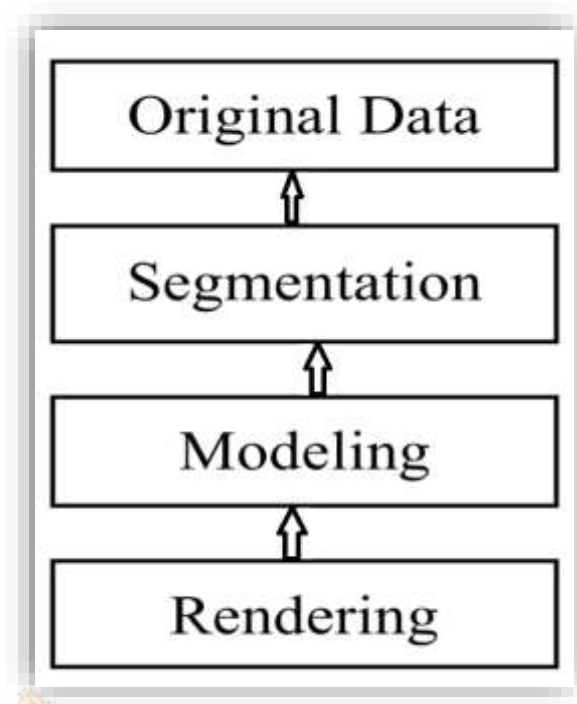


Fig. 2 Flow of MC Algorithm

A. Segmentation

The segmentation results will directly influence the accuracy of object reconstruction. The segmentation method is designed for a modularization, therefore segmentation method designed differently according to the features of the original function i.e. images from equipment.

B. Modeling

The mainly modeling is known as a construction or forming from one to another. Thus modeling is a process which creates a three dimensional object from the two dimensional object. It works on 2D slice and its sequence to generate three dimensional objects.

C. Rendering

Rendering is nothing but a process which finds some parameters which define previously for a visualization in object. In this visualization contains parameter like viewing angle, color, lighting, types of material which used in visualization. So the user can view able to see the object from any angle with an advanced color and shape.

The Rendering term is also used to describe the process of calculating effect in a program to produce the final output. It include method and algorithms like rasterization, ray casting, ray tracing etc. [8].

IV. CONSTRUCTION AND ORGANIZATION OF THREE DIMENSIONAL SCENES.

When user rendering the three dimensional scenes the amount of scene data, network speed or transmission mode, group scheduling policy is directly affected by the structure of the model data. It means that 3D object formation will require space occupation, fast transmission, and good graphic interface.

This can be overcome using glTF which designed especially Web-GL interface. The structure of glTF interface is divided into mainly 4 parts.

a. JSON file

JSON file is core of the entire model which stores an entire scene data received for web server i.e. nodes level, material quality, cameras, and lighting parameter of the object.

b. Binary file

The binary file is using to store a graphic data such as texture, vertex coordinate, indices and so on.

c. Image file

The image file used to store the texture of object. Mainly this file can be created using above both file on the user space.

d. Shader file

This file includes the vertex shader and fragment shader, which are required for graphic rendering. The main advantage of glTF is that it directly connected to the Graphic Library interface. Its parameter of the model can be directly mapped to the functions and GL interface [9].

V. LITERATURE SURVEY

Ling Lei et.al [10] highlights digital campus system, which is combined with Web-GL and Application programming interface. It is a system of communication built as a web application with the function of viewing 3D virtual environment. The system virtualized the campus environment and shares the information on the internet. For this system they used HTML5, Java Script, and sketch up 3D studio max for a creating view to publish on internet.

Ahyun Lee et.al [11] states about ray casting technique via using 3D spatial information. They propose a mouse picking method to select desired spatial information for a user when 3D information is available to visualize. In this paper they proposed a method which effectively selects a target object with minimizing the calculating time.

Hyowon Kim et.al [12] in this research the Web-GL introduced as one of the powerful web feature for developing 3D content. With this they stated some performance issue of Web-GL when it compared with native Graphics Library. In their research they present an optimized rendering model when Web-GL is used as dominant content like games which is in 3D and they presents effectiveness with performance on the embedded device

Gongjin Qin et.al [13] presents excellent Browser/server architecture to realize the 3D visualization. In their architecture user completely used interface through their Web-GL enabled browser. In their research they describe the parsing process of B3DM file and analyzed rendering process of different engines. The B3DM file is nothing but batched 3D model which is part of 3D tiles specification and indeed B3DM uses glTF as its payload to deliver 3D scene.

Vinay Kumar R et.al [14] present a tool which is helpful for the user who don't have programming knowledge. The application contains graphical programming language used for generating 3D predefined object using computational algorithm.

Jana Pocsova et.al [15] described a web based tool for creating interactive presentations with 2D and 3D visualization of mathematical object. Through this author provide a way to enhancing ability of mathematical concept. The concept has been designed using Java Script and Web-GL.

Umer IJAZ et.al [16] proffing a concept of a downloading, decoding and rendering 3D objects using web base receiver. This research demonstrate of performance and effectiveness when highly compressed 3D object are used. This work can also extend for future for a dynamic 3D object and its animations.

Yong kang peng et.al [17] in this research the researches a theory of Web-GL based VR system. They mentioned two algorithms which proposed and applied to the VR system. They exchanges data in the form of packages via using JSON format the package contains encapsulated data which hiding internal data and functions in the systems.

Da Young Lee [18] this paper proposed a visualization model for alignment sequence which designed to reveal base sequence of alignment result which is 3D walk plot model. A System can build using Web-GL based web system.

Ru Miao et.al [9] in this research describes three-dimensional scenes visualization system and states about recent development in HTML5 Web Graphics Library etc. And discuss about a design and implementation of digital city roaming based on Web-GL. So that users can make data query, map mark etc. with system in their own devices.

VI. CONCLUSION

In this paper describes the various ways of implementing real-time three-dimensional object with an algorithm such as marching cubes, as well as about glTF file representation which designed for an Web-GL interface and learn about various web transmitting ways like web service, JSON etc. and discuss about how storage capacity increased or decreased via adding pixel and its color models like RGB and CMYK. With this we see Web-GL compatibility with different applications in cross-platform and cross-browser compatibility.

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