

Methodology for Digital Compression of Virtual Worlds using VRML

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Abstract:

Virtual Reality Modelling Language called as VRML was an initial step in the direction of Web 3D. Second version of VRML called as VRML2 or VRML97 is an international Standard of 3D representation on Web with support for interactive behaviors. Web 3D is also sometimes referred as 3D on web. Web 3D allows user to browse 3D contents using Internet browsers like Internet Explorer, Mozilla Firefox, Opera, Google Chrome and so on. Alternatively, there are many other alternative technologies of Web 3D similar to VRML but VRML is widely accepted format of import/export utility for many popular CAD software for exchange of CAD data. Moreover, VRML code can be easily imported in software like MATLAB which gives more controls for further development. This paper proposes new methodology of constructing VRML worlds which enables extreme data compression suitable for virtual worlds constructed out of high polyline objects. With proposed new methodology, it is possible to develop mobile App with less than 10 MB size for VRML world. The proposed new methodology enables users to create interactive VRML worlds without any data or functionality loss. The proposed methodology helps in expanding scale and boundaries of Virtual Worlds which was limited to few 3D objects with Conventional Methodology. This paper discuss how VRML worlds can be endlessly expanded with space jump concept.

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1. INTRODUCTION: CONVENTIONAL METHODOLOGY OF BUILDING VIRTUAL WORLDS USING VRML

Virtual Environment created with VRML are called worlds. VRML worlds can be static or interactive or combination of both. Conventionally, VRML worlds are created by adding one or more 3D/2D or combination of these objects together. The VRML world is represented by *.wrl file extension which means World. VRML do not differentiate between a single object world or world with multiple objects and both are represented by *.wrl extension. VRML virtual worlds are built with addition of two or more objects together in conventional methodology. The problem arises when users wants to expand or populate VRML world similar to our real world. Our real world consists of people, trees, buildings, roads,

sky, clouds, water etc. and it definitely in 3D. The 3D virtual world build with VRML can be populated by adding more objects so as to make them realistic. The process of populating VRML world with more and more objects is restricted by computer processing power. Computer have some definite processing power according to their generations. If the data exceeds beyond this limit, either processing will be slow or user may experience sluggishness/lag while browsing VRML world. Sometimes such files may take long time to load in Internet Brower. This is due to the fact that VRML world browsing requires real-time rendering which consumes excessive computer processing power. The limitation of conventional methodology is that with addition of objects together it grows in final output. If a user has created an objects of 25 Kilo

Bytes size and another of object of 30 Kilo Bytes The graphical representation of conventional size, then resulting file will be 55 Kilo Byte size. methodology can be given as follows.

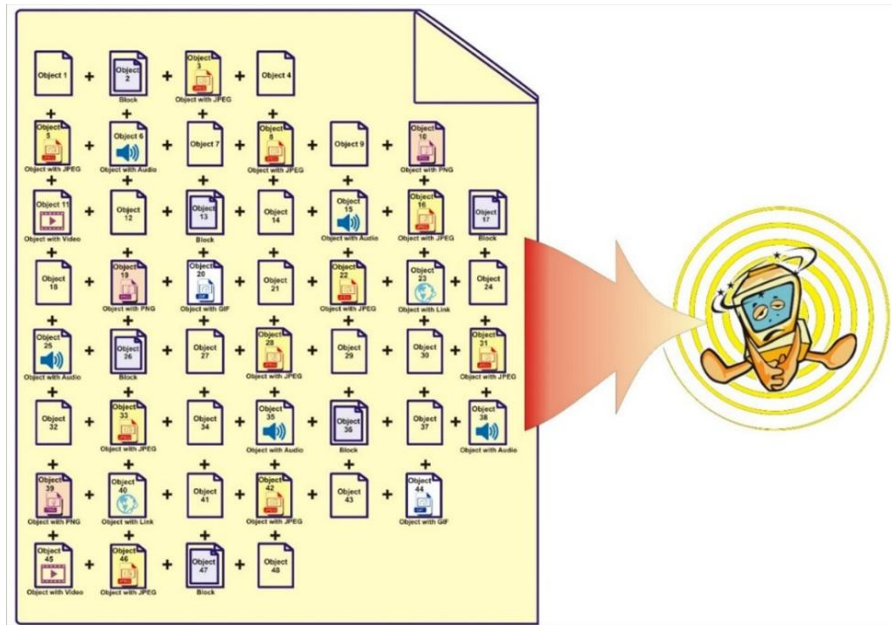


Figure 1. Conventional methodology of building Virtual Worlds using VRML

The figure shows on bigger size file icon housing several small files together. This files represents final output VRML world created by adding several small files together. Each small file icon represents an object either 2D/3D. The object can be associated with some texture, sound or video which is represented by sound, texture or video symbol inside file icon as shown in figure 2.

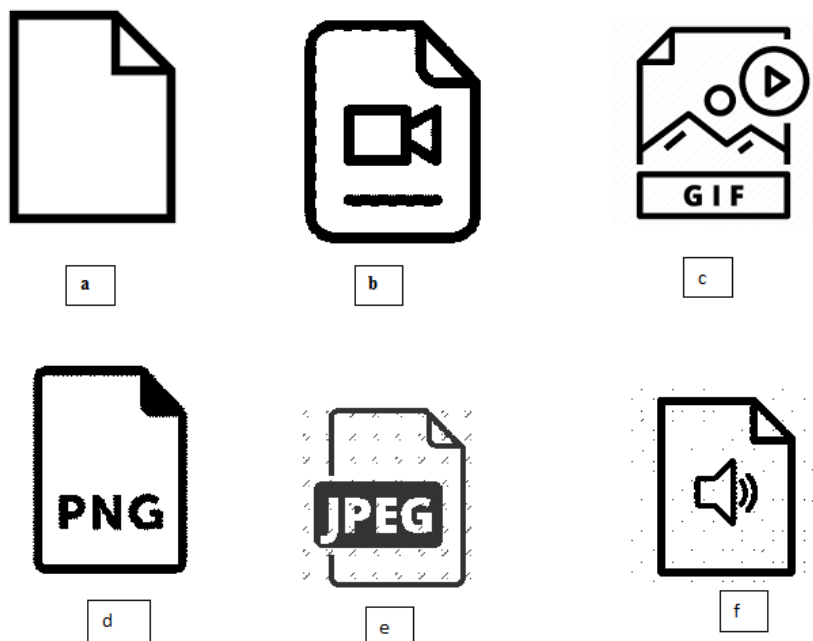


Fig 2: VRML objects with their associated files

Simple object file without any associated texture, sound or video
b) Object associated with video file
c) Object with animated GIF format image file
d) Object with high resolution PNG format image file
e) Object with associated JPEG image file
f) Object with associated sound file

The conventional methodology of building Virtual Worlds using VRML results in growth of file size with expansion of Virtual World. This will lead to generation of bulky output file for loading and navigate. It was observed that VRML world beyond 100 Mega Bytes size will experience slight delay in loading or navigation. File size more than 200 MB will have considerable effect on loading and navigation. It is observed that file size growth will lead to more loading time and sluggish navigation

experience. Moreover, loss of interactivity was observed in case of interactive VRML world build with conventional methodology. Interactivity in VRML worlds can be achieved using VRML sensors like proximity, touch, plane, cylindrical, sphere etc.

2. METHODOLOGY FOR DIGITAL COMPRESSION OF VIRTUAL WORLDS USING DIGITAL TAGS

Data compression techniques are widely used for computer file compression. Win Zip or Win RAR utilities are quite common for a computer user. Similarly, compression techniques are used for audio and video compression. Popular MP3 file format employs such audio file compression technique.

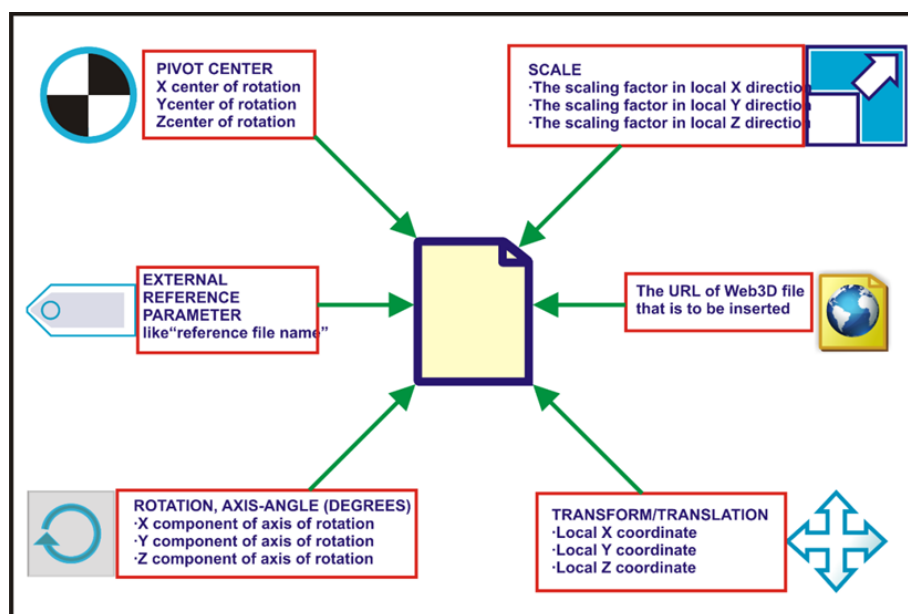


Figure 3. Digital tag for Digital Compression of VRML World

The figure shows the concept of digital tag developed for compression of VRML world file. The TAG have six attributes assigned to it as follows

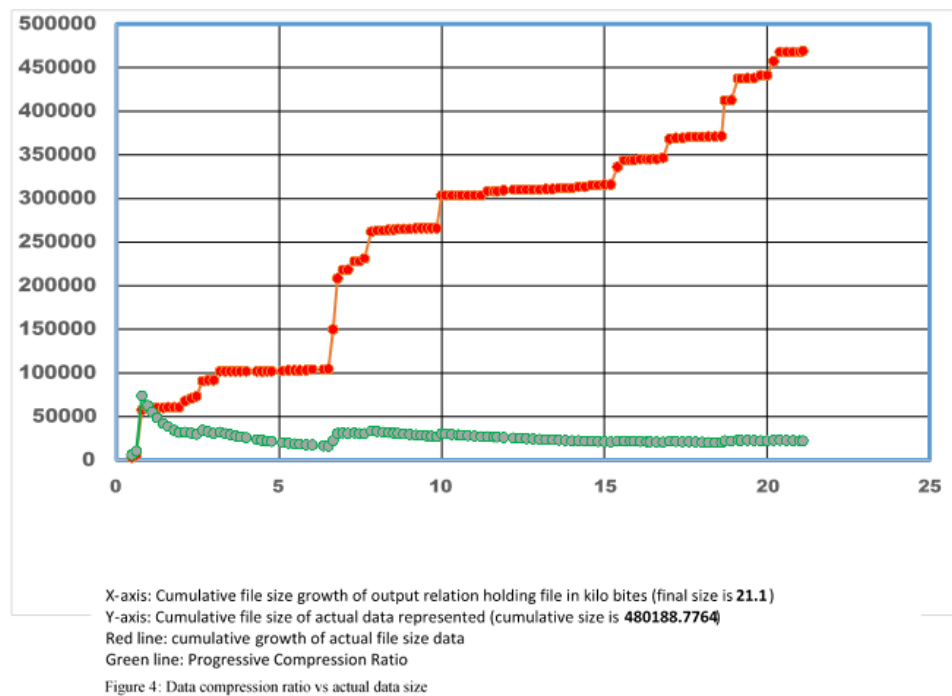
- Pivot center.
- Scale factor (in X, Y, and Z direction)
- URL of web 3D file that is to be inserted if file is fetched from web server.
- Translation in Local X coordinate, Translation in Local Y coordinate, Translation in Local Z coordinate.

- X component of axis of rotation, Y component of axis of rotation, Z component of rotation.
- External reference parameter like "reference file name"

The Virtual Worlds build using Digital Tags were found to be highly compressed without loss of interactivity. The digital Tags expanded the limits in terms of number of objects to be included in a single

VRML world, summarization of maximum possible VRML sensors in a single VRML world environment and complexity of polyline objects. The Digital Compression Methodology of building VRML

worlds using Digital Tags enables user to include more complex polyline objects. The digital compression can be plotted as shown in figure.



The graph indicates that Digital Compression Methodology of compressing VRML world gives extreme compression ratio.

3. RESULTS AND DISCUSSION

The virtual world build with the Methodology for Digital Compression allowed to accommodate complex polyline objects along with various VRML sensors like touch, proximity, plane, string, cylinder, sphere etc. The site map of virtual world build is as shown below.

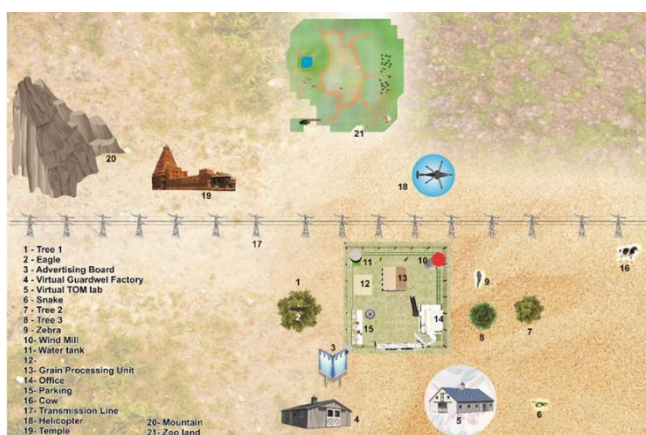


Figure 5.: Site plan of Virtual World

The Virtual World build with digital tags comprises of more than 300+ objects with some objects are high polyline objects. The Virtual World consists of Agro Processing unit comprising of Seed Grader, Gravity Separator and Destoner machine. Methodology for Digital Compression allowed Graphical Simulation of Agro Processing Unit along building external (Outside Agro Processing Unit) and internal (Inside Agro Processing Unit) environment. Several other objects like Virtual Theory of Machine Lab, Guardwell Factory, Zoo Land, Temple, Mountain along with living organisms like birds, Animals were intentionally added to populate Virtual World so as to check saturation limit of proposed Methodology for Digital Compression. The saturation was indicated by Web Authorizing Tool Vivaty Studio (formerly known as Flux Studio) with error message shown in figure 6.

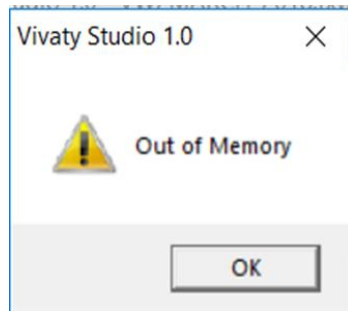


Figure 6: Web authorizing tool Vivaty Studio 1.0 showing error message indicating saturation limit

The environment parameters like Speed, Transparency, Light Intensity, Sun Light Intensity, Color of Virtual World build with VRML can be controlled using MATLAB. Figure 7 shows such Graphic User Interface.

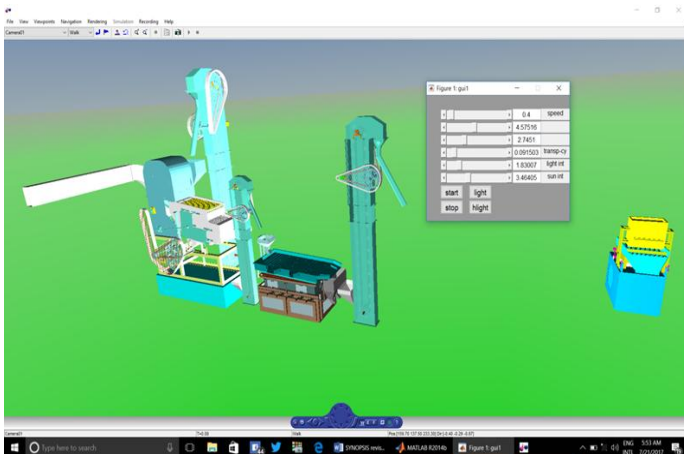


Figure 7: Graphic User Interface (GUI) developed in MATLAB's Simulink software for controlling Virtual Environment

The Virtual World Build with Methodology for Digital Compression do not support GUI development for controlling environment parameters with MATLAB. The environment parameters can be controlled with conventional methodology i.e. building Virtual World by adding objects together. The Methodology for Digital Compression of VRML world is a breakthrough in building interactive scaled up VRML world involving several high polyline objects.

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