Lightweight Web3D Key Technologies for 3D Commerce Application

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Why WebVR?

- Internet+ made great successes before 2015
  - Especially in China (BAT)
- VR+ suddenly popped up in 2016
  - But its industrialization has not been successful
  - VR+ became fading and AI+ prosperous gradually
- How to make VR industrialization successful
- VR+ should be combined with Internet+
  - Internet+ has good business model
  - (Mobile) Internet based VR
    - Web Browser Based VR

Internet+ + VR+ = WebVR++
Challenges of WebVR

1. **Data Bottleneck**: 3D data are too heavy

2. **Transmission Bottleneck**: too slow to wait

3. **Rendering Bottleneck**: too slow and too bad

4. **Lightweighting**: too expensive and complicated

5. **Few Research**: no overall or systematic solution
Outline

1. Introduction to WebVR
2. Challenges of WebVR
3. Key Technologies of WebVR
4. Lightweight WebVR Engine
5. Demonstrative Application
1. **Lightweight Web3D Modeling**
   Efficient, Low-cost, Lightweight

2. **Progressive Web3D P2P Transmission**
   Loading the interested scenes instantly

3. **Lightweight Web3D Rendering**
   Lightweight, Fast, Realistic, Beautiful

4. **Lightweight Web3D Engine or Platform**
   Big Data, Online, No Plugins, Convenient
Repetition Based Lightweight Web3D Modeling

- Voxelization feature extraction of entities for similarity retrieval to remove those repetitive entities
- Only transmit those repetitive entities once from server, but instance rendering them many times at Web Browsers
Lightweight SceneGraph

- For Easy Internet Transmission and Web Rendering

Combine lightweighting and PM streaming together
Fine-Grained Preprocessing of Big BIM Data

Lightweighting + Streaming + Segmenting

Efficient Low-cost accurate

Fine-grained Scenegraph
This demo can be shown by accessing the following Web Link

http://youku3d.com/smart3d/ceilinglight/

or by scanning the QSR code with your mobile phone
Data Size: 100M  (accurately for Designing)

http://www.shxt3d.com:5378/
Progressive Transmission

Minimizing the data size to download at each step

Overlapping Voxels
Translating Decrement
Translating Increment

Incremental FOI
Lightweight Online Visualization of Web3D Big Data

Fine-grained Preprocessing

- Semantic Lightweighting
- Geometric Lightweighting
- Triangular Mesh Strip Buffer
- Converting glTF
- Lossless Draco Compression
- Binary Conversion

Progressive Peer to Peer Transmission

- Incremental Frustum of Interest
  - Fill Degree
  - Attention Degree
  - Repetition Degree
- User Behavior Analysis
- Interest Based Physical Peer Networking
- WebRTC Based Web3D P2P Transmission

Multi-threaded Online Loading/ Parsing/ Rendering

- Decompressor/ Parser using Web Assembly
- Instance Rendering
- Adaptive Web3D Caching
Lightweight Mobile WebBIM Demo (2)

- SmartCity with 4 buildings and 3 underground spaces,
- 279,019 entities and 39,260,000 triangles,
- 10 minutes to open 2GB using Revit

http://106.15.190.126/web_bim/sg.html
Introduction to WebVR++

Challenges of WebVR

Key Technologies of WebVR

Lightweight WebVR Engine

Demonstrative Application
Cloud Baking Based Lightweight Web3D GI Renderer

**Web front-end**

1. **Lightweighted 3D scenes** → **Load and manage scene**
2. Make GI request based on user operation
3. Update render queue
4. Deferred rendering based direct lighting
5. Blend web direct lighting and cloud indirect lighting

**Web socket**

**Cloud server back-end**

1. **Original 3D scenes** → **Load and manage scene**
2. Is web request GI?
3. Receive camera and lighting information
4. Update camera and lighting
5. Multiple GI algorithms based indirect lighting
6. Create GI map
7. Encode GI map frame

**Lightweighted scene loading and management**

**Make GI request based on user operation**

**Update and transmit scene information**

**Direct lighting calculation**

**Blending**
Cornell Box

(1) without Could Baking GI

(2) With Could Baking GI
Demo (2)

- **Sponza**

  a. Without Cloud Baking  
  b. With Cloud Baking
Framework of Lightweight WebVR Engine

Lightweight modeling

- Rule-based lightweight modeling
- Sketch based lightweight modeling
- Image or vision based lightweight modeling
- Search based lightweight modeling

Web3D Assets Library
- Lightweight 3D Models
- Texture
- Lightmap
- Materials
- Scripts
- Animation
- Shader
- ……….

P2P WebVR Assets Management System

P2P progressive downloading protocol

Web Visualization Services Platform

WebVR Projects

Lightweight WebVR engine
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Lightweight Web3D Furniture Commerce

http://www.shxt3d.com/housecolider/

**Collision Detection Methods:**
1. Sparse Octree
2. Norton Coding
3. Binary Computing

Lightweight Online Collision Detection

**Advantages:**
1. Lightweight
2. Efficient
3. Low Cost
4. Accurate
Lightweight Web3D Furniture Commerce

Distance Field and Case Reasoning

Layout Energy of Furniture Distribution

http://106.15.190.126:5555/
Thanks!

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