

Updates on Projective Texture Mapping

ISO/IEC JTC 1/SC 24/ WG 6 Plenary Meeting

Web3D Consortium

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Contents



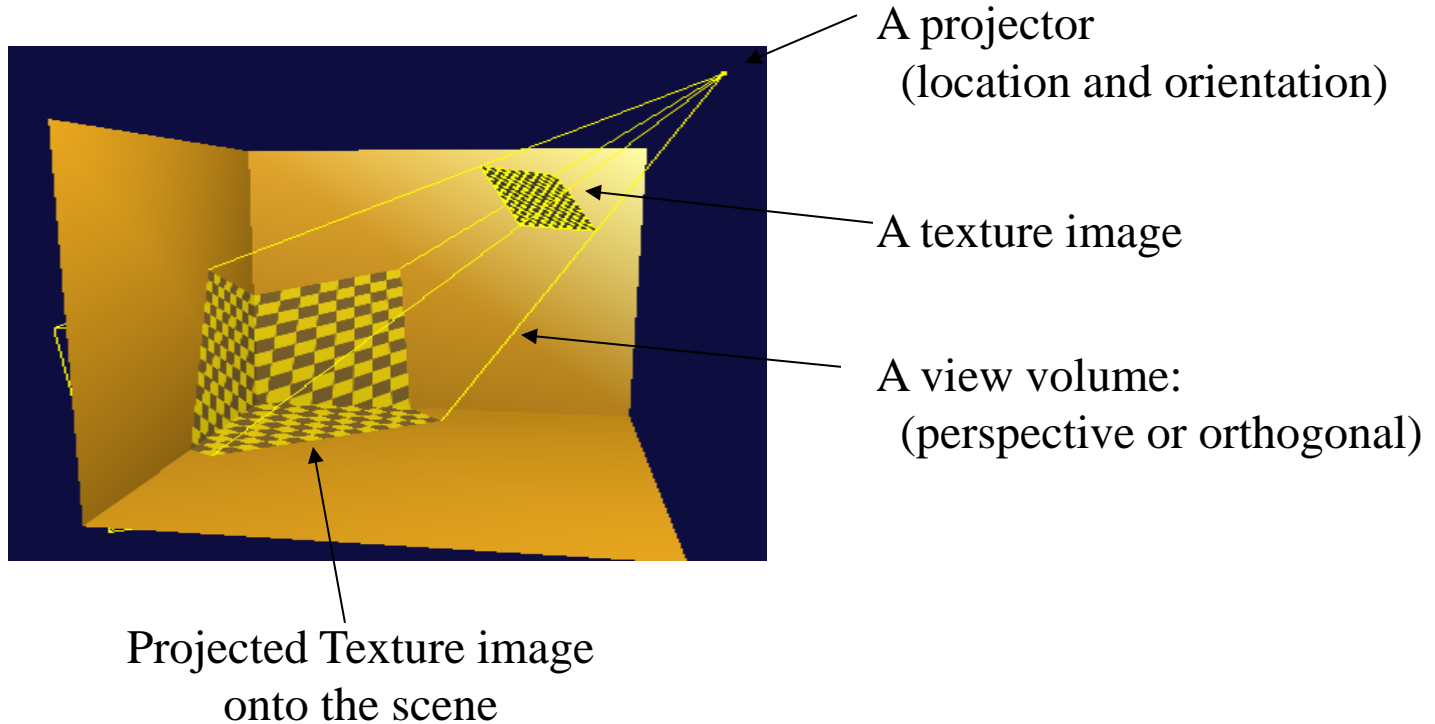
I Brief Discussion

II Proposed Nodes

III Example

I. On Projective Texture Mapping

- A method for texture mapping which allows the texture image to be projected onto the scene as if by a slide projector[Cass Everitt, 1999)



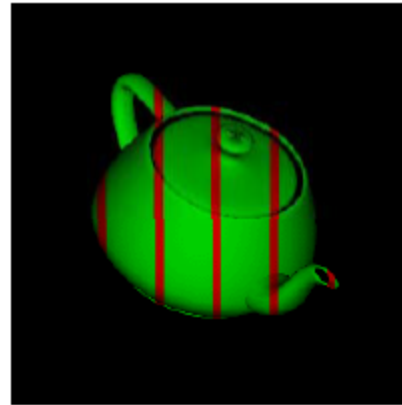
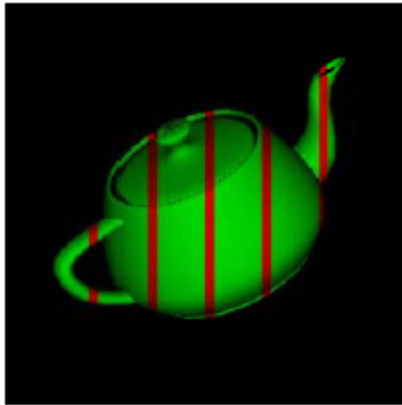
DEMO

I. History

- The projective texture mapping was proposed as standardization item into X3D at SC24 WC6 Meeting, 2008
 - * Any nodes for projective texture mapping are not specified into X3D yet
- For last four years, several sample examples for projective texture mapping have been developed.
- Current, implementation results of projective texture mapping have transferred into X3D browsers such as freeWRL, Xj3D etc.

I. Projective Texture theory

- Eye Linear
 - Texture is “fixed” in eye space



I. Projective Texture theory

- Eye Linear

$$\begin{bmatrix} s \\ t \\ r \\ q \end{bmatrix} = \mathbf{T}_e \begin{bmatrix} v_x \\ v_y \\ v_z \\ v_w \end{bmatrix}_{eye}$$

Eye Linear Texgen Transform

– multiply Eye space coordinate and T_e (Texgen matrix)

I. Projective Texture theory

- Eye Linear Texgen Transform

glTexGen automatically applies this when modelview matrix Contains just the eye view transform

$$\begin{bmatrix} x_e \\ y_e \\ z_e \\ w_e \end{bmatrix} = \begin{bmatrix} \text{Eye view (look at) matrix} \\ \text{Modeling matrix} \end{bmatrix} \begin{bmatrix} x_o \\ y_o \\ z_o \\ w_o \end{bmatrix} \quad \text{Eye space coordinate}$$

$$\begin{bmatrix} s \\ t \\ r \\ q \end{bmatrix} = \underbrace{\begin{bmatrix} 1/2 & 1/2 \\ 1/2 & 1/2 \\ 1/2 & 1/2 \\ 1 & \end{bmatrix}}_{\text{Te(TexGen matrix)}} \begin{bmatrix} \text{frustum (projection) matrix} \\ \text{view (look at) matrix} \\ \text{Inverse eye view (look at) matrix} \end{bmatrix} \begin{bmatrix} x_e \\ y_e \\ z_e \\ w_e \end{bmatrix}$$

Strategies for defining Projective Texture Mapping in X3D

- First Strategy: Within Appearance Node
 - Adv.: to reflect specific appearance property on each scene object.
 - Disadv.: not easy to reuse the predefined projective texture mapping information
- Second Strategy: As Group Node
 - Adv.: to reflect specific appearance property on an object included within group geometry scene.
 - Disadv.: not easy to reuse the predefined projective texture mapping information
- Third Method: Like as LightSource
 - Adv.: to reuse the predefined projective texture mapping information
: simple to use and also to declare PTM

GOOD

II. Proposed Nodes

X3DProjectiveTextureNode

X3DProjectiveTextureNode : X3DChildNode

PerspectiveTexture : X3DPerspectiveTextureNode

ParallelTexture : X3DPerspectiveTextureNode

II. Proposed Nodes

X3DProjectiveTextureNode

```
X3DTextureProjectorNode : X3DChildNode{
    SFNode      [in,out]      metadata          NULL
                                   [X3DMetadataObject]
    SFString    [in,out]      description          ""
    SFVec3f     [in,out]      location              0 0 1
    SFvec3f     [in,out]      direction             0 0 1
    SFBool      [in,out]      global
    SFBool      [in,out]      on
    SFNode      [in,out]      texture              NULL
                                   [ImageTexture | MovieTexture]
}
```

II. Proposed Nodes

PerspectiveTexture

```
TexturePerspectiveProjector : X3DTextureProjectorNode {
  SFNode      [in,out]      metadata          NULL
                                     [X3DMetadataObject]
  SFString    [in,out]      description          ""
  SFVec3f     [in,out]      location                0 0 1
  SFVec3f     [in,out]      direction               0 0 1
  SFFloat     [in,out]      fieldOfView             45
  SFFloat     [in,out]      aspectRatio              1
  MFFloat     [in,out]      nearFar                  1 10
  SFBool      [in,out]      global
  SFBool      [in,out]      on
  SFNode      [in,out]      texture                 NULL
                                     [ImageTexture | MovieTexture]
}
```

II. Proposed Nodes

ParallelTexture

```
TextureParallelProjector : X3DTextureProjectorNode{
  SFNode      [in,out]      metadata          NULL
                                     [X3DMetadataObject]
  SFString    [in,out]      description        ""
  SFVec3f     [in,out]      location              0 0 1
  SFVec3f     [in,out]      direction              0 0 1
  SFVec3f     [in,out]      volume                 1 1 1
  SFBool      [in,out]      global
  SFBool      [in,out]      on
  SFNode      [in,out]      texture NULL
                                     [ImageTexture | MovieTexture]
}
```

Thank you

Q&A

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II. Other Issues

ProjectorLight

```
ProjectorLight : X3DLightNode {  
    SFNode      [in,out] metadata      NULL  
                [X3DMetadataObject]  
    SFFloat     [in,out] ambientIntensity 0 [0,1]  
    SFCOLOR     [in,out] color 1 1 1 [0,1]  
    SFBool      [in,out] global FALSE  
    SFFloat     [in,out] intensity 1 [0,1]  
    SFBool      [in,out] on TRUE  
    SFFloat     [in,out] fieldOfView 45.0  
    SFFloat     [in,out] aspectRatio 1.0  
    SFNode      [in,out] texture      NULL  
                [ImageTexture | MovieTexture]  
}
```