Differences Of Cube Mapping and Dynamic Cube Mapping

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Abstract

Growth of animation's 3D caused by progressing in computer graph especially technic in environment mapping. This way is very useful in creating an animation becoming real. This technic generally is implementation using application OpenGl. In Environment Mapping has divided into 3 parts which are Paraboloid Mapping, Sphere Mapping, and Cube Mapping. From all this technic which is very interested the progress by scientist is Cube Mapping. Because of that, this paper will present the differences between Cube Mapping and Dynamic Cube.

In this paper will focus on the explanation about the beginning of Cube Mapping including the development which is done by Cube Mapping up to have characteristic and it is dynamic which is well known as Dynamic Cube Mapping. Beside that, there will be explanation about superiority Cube Mapping and Dynamic Cube Mapping, differences between Cube Mapping and Dynamic Cube Mapping, and the development of Cube Mapping becoming Dynamic Cube Mapping which is generally using application from OpenGl and conclusion from Cube Mapping and Dynamic Cube Mapping. With this paper, hope for we know about ways of environment mapping especially Dynamic Cube Mapping and then we can implement this ways into all of objects to create the high art's creation.
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1 Background

Development of computer graphic in this moment has grew up quickly. In computer graphic which is one of field in scient that processing an input from an object and process that input which could be model or picture that having useful information. One of field from computer graphic have been developed of scientist there is creating environment mapping for animation 3D especially in cube which has been known as Cube Mapping and now have grew up becoming Dynamic Cube Mapping.

This case has been improved by appearing of Cube Mapping research that is Nvdia have done. Nvdia have tried to develop any tools for creating right Cube Mapping which is for quality of cartoon graphic that have been resulted increasing cause of technic of Cube Mapping is a graphic standard that have been decided since appearing of DirectX7 which is background the writer to discussed about dynamic cube deeper.

2 Sphere Mapping

Creating sphere map is using photograph a lighting ball or like as shown by lens of fish's eye. This technic could be called as Half Sphere Mapping. Unfortunately, this technic is generally only useful for resulting an object which is looked in 1 position and 1 point of sight, this case could not be avoided. If using this technic and could be resulting reflection satisfying usually need a complicated technic, in practicing use limitation of object with image warping and distortion, view-point dependency, the inability to render real-time, and the costly human effort and computational time required to implemented technic of sphere mapping.

3 Cube Mapping

Cube Mapping which is part of environment mapping could result a good quality of object with aid of hardware which is application of GeForce 625 and supported fully by DirectX7 and OpenGl which is allowing users to create accuracy in object including reflection as real. Progress of development which could be resulted by this hardware can implemented cube mapping until creating object is easier. Changes of form in mapping on 6 side of cube, cube map-

ping has offered development of an object easily to create unnerved of reflection from an object which has resulted.

Base on cube mapping, it is development of sphere mapping and environment mapping. Cube mapping is technic which using coordinate texture of 3D and reflected a texel from cube map is gived. Cube or box mapping use 6 individual square texture which is mapped into a virtual cube, than a single texture which is mapped into virtual sphere. Picture number 3 will show form of cube mapping. Technic which is using by cube mapping is technic used too by sphere mapping in resulting an object satisfying.
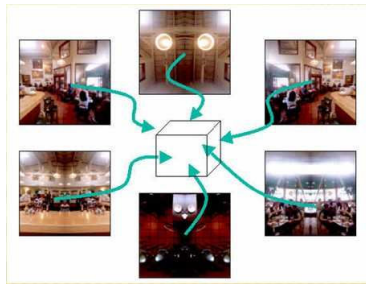

Figure 1. 6 side of Cube

3.1 Ways of Creating Cube Mapping

3.1.1 Declaration

In this part, there will be some of command that must be noticed, that is:

1. *Window*, useful for layer in program

2. *dglOpenGl*, a procedure or class that we will callibrary of OpenGl

3. *Graphics*, useful in picture, example: size, coordinate, etc.

4. *Classes*, to import texture of picture which is in format "JPEG"

5. *SysUtils*, necessary of other utility's system

3.1.2 Swap Formation BitMap of GBR into RGB

In this section will show codes which approximately with program of our OpenGl, that is:

1. Creating texture

   This part will show code of texture, that is:

   ```
   procedure SwapRGB(data :  Pointer; Size
   :  Integer);
   asm
   ```

```
mov ebx, eax
mov ecx, size
@@loop :
mov al,[ebx+0]
mov ah,[ebx+2]
mov [ebx+2],al
mov [ebx+0],ah
add ebx,3
dec ecx
jnz @@loop
end;
```

In this part will shown codes for making texture, that is:

```
function CreateTexture(Width, Height,
Format :  Word; pData :  Pointer;
pMagFilter, pMinFilter :  TGLUInt;
pTarget :TGLUint) :  Integer;
var
Texture :  TGLuint;
begin
glGenTextures(1, @Texture);
glBindTexture(pTarget, Texture);
{ Select a filtering type.  BiLinear
filtering produces very good results
with little performance impact
GL_NEAREST – Basic texture (grainy
looking texture)
GL_LINEAR – BiLinear filtering
GL_LINEAR_MIPMAP_NEAREST – Basic
mipmapped texture
GL_LINEAR_MIPMAP_LINEAR – BiLinear
Mipmapped texture
}
glTexParameteri(pTarget,
GL_TEXTURE_MAG_FILTER, pMagFilter);
glTexParameteri(pTarget,
GL_TEXTURE_MIN_FILTER, pMinFilter);
if Format = GL_RGBA then
gluBuild2DMipmaps(pTarget, GL_RGBA8,
Width, Height, GL_RGBA, GL_UNSIGNED_BYTE,
pData)
else
gluBuild2DMipmaps(pTarget, GL_RGB8,
Width, Height, GL_RGB, GL_UNSIGNED_BYTE,
pData);
result :=Texture;
end;
```

Those code depend on texture that we want and we can search in code's OpenGl

2. Creating Load BMP Texture , JPEG, and 24 and 32PP(Alpha Channel) TGA Texture

This part will show code of texture which loading with BMP texture, JPEG, and 24 and 32PP(Alpha Channel) TGA Texture which are: `function LoadBMPTexture(Filename: String; var Texture : TGLuint; LoadFromResource : Boolean; pMagFilter, pMinFilter, pTarget : TGLUInt) : Boolean;`

```
..

end;
```

This code is depending on condition of exception. Thing that we should know that in *LoadBMPTexture*. In that code, we only chage BMP become kind of picture that we want.

3.1.3 Rendering

In Dynamic Cube Mapping there are 6 environment or called as 6 side which must be rendered for improvement the appearance. This is done to get maximal result in 3D object. Important thing which is point of differences from codes in six side is differences in coordinate in all of cube including vertexs in all of side. This is caused placement side of cubes is different one each other from all coordinate. As follow is codes of environment for side in cube, that is:

```
glBindTexture(GL_TEXTURE_2D,EnvironmentBox[2]);
  glBegin(GL_QUADS);
  // Front Face
  glNormal3f( 0.0, 0.0, -1.0);
  glTexCoord2f(1.0, 1.0);
glVertex3f(-iBoxSize, -iBoxSize, iBoxSize);
  glTexCoord2f(0.0, 1.0); glVertex3f(
iBoxSize, -iBoxSize, iBoxSize);
  glTexCoord2f(0.0, 0.0); glVertex3f(
iBoxSize, iBoxSize, iBoxSize);
  glTexCoord2f(1.0, 0.0);
glVertex3f(-iBoxSize, iBoxSize, iBoxSize);
  glEnd;
```

In that codes, seen that size of cube for all side is 8 cm. In that codes that coordinate is coordinate 2D which is caused side in cube is come from picture 2D but in cube is picture 3d. Changes of 2D into 3D could be done with placement coordinates in all sides. Beside rendering, thing that must be done in this program is repairing from kinds of original texture becoming new texture which having shape and texture better that before. This things could be done using GL_TEXTURE_CUBE_MAP. Function of glTextCoord2f is for showing coordinate's texture. Function of glVertex is creating drop of cube environment mapping.

3.1.4 Enable-Disable

```
glEnable(GL_TEXTURE_CUBE_MAP_EXT); // Start
cube mapping
  glEnable(GL_TEXTURE_GEN_S);
  glEnable(GL_TEXTURE_GEN_T);
  glEnable(GL_TEXTURE_GEN_R);
  glBindTexture(GL_TEXTURE_CUBE_MAP_ARB,
CubeMap_TEX);
  drawMetaballs(ElapsedTime);
  // Restore OpenGL States
  glBindTexture(GL_TEXTURE_CUBE_MAP_ARB,0);
  glDisable(GL_TEXTURE_CUBE_MAP_EXT); // Stop
Cube Mapping
  glDisable(GL_TEXTURE_GEN_S);
  glDisable(GL_TEXTURE_GEN_T);
  glDisable(GL_TEXTURE_GEN_R);
```

That codes is ways of dynamic cube mapping's program which running texture from cube mapping including metaball, is object in center of this environment cube mapping which using technic of sphere for displaying.

3.1.5 Action Environment

```
MouseMove : boolean = false;
  MoveXcoord, MoveYcoord : GLfloat;
  MouseButton : Integer = -1;
  Xcoord, Ycoord : Integer;
```

In this codes could be seen the movement in `MouseMove` which gived false value because it is considered that user yet doing movement in beginning when program is running. While in action `MouseBotton` given -1 because considered that user yet click and action in that event. As follow will show procedure for actions that could be happen in dynamic cube's program, which are move mouse, mouse button, or action key in keyboard.

1. Action Mouse Button

```
procedure ProcessMouseClick;
begin
case MouseButton of
1: // Left Mouse Button
begin
MouseButton := 0;
end;
2: // Right Mouse Button
begin
MouseButton := 0;
end;
3: // Middle Mouse Button
begin
MouseButton := 0;
```

```
end;

end;

end;
```

In action of Mouse Button is every action considered by user although clicking right, left, or center will caused value of receiver variable becoming 0 which means true because first value is -1. This action is not too involving in program. As follow, this is code showing every process movement of mouse which value is false: \\

```
begin

if MouseMove then

begin

MouseMove := False;

end;

end;
```

2. Action Key

```
procedure ProcessKeys;

begin

if (keys[VK_RIGHT]) then ySpeed :=
ySpeed + 0.002;

if (keys[VK_LEFT]) then ySpeed := ySpeed
- 0.002;

end;
```

In action key, the right know will cause addition of speed from rotation in rendering of dynamic cube mapping. The other way, left knob cause the rotation becoming slower. In conclusion, proven of last explanation that rotation in dynamic cube could be done with any event in this case with clicking the knob in keyboard.

3.2 Superiority of Cube Mapping

Implementation of using cube mapping have impact which benefit moreover cube mapping is consolidation of 2 technic which come from environment mapping, that is sphere mapping and cube mapping. As follow is some of beneficial of implementation cube mapping:

1. Result is we can mapped is smoother and there is no problem with visual

2. Cube mapping could be economical in using memory, as big as total of texels which amount of could be smaller or same for better quality of visual.

3. Cube mapping should be running faster, which is nedding some of logic as comparison to get final coordinate texture from invers of trigonometry function.

4. Other profit is cube mapping have 6 side a look which size is 90 degrees and could be rendered as actual when fly and swing.

4 Dynamic Cube Mapping

Dynamic Cube Mapping is form mapping of 3D which present some of pictures in one same place into cube until creating a dynamic picture along with using a texture to make pretty. Like explanation before that dynamic cube mapping is technic cube mapping which is texture cube map could be rendered every single frame. Dynamic Cube Mapping is development of Cube Mapping. In dynamic cube mapping environment which is mapped in its cube have the quality of dynamic which appropriate with amount of texture in its environment that reflection the light. The aim of cube mapping is for testing the quality of 3D' pictures in one of media which is computer especially in card of computer graphic(VGA) for resulting environment and texture of a good picture. And, object in dynamic cube mapping could move as good.

4.1 Ways of Creating Dynamic Cube Mapping

Ways of creating dynamic cube mapping is almost same with cube mapping, but amount of texture that must be rendered is more than usual. Basically, technic in creating Dynamic Cube Mapping is almost same with Cube Mapping which are having some of differences in initialization and environment mapping whereas for declaration, rendering, and action mouse of disable-enable have same ways with Cube Mapping.

4.1.1 Initialization

Useful for loading images including another process to support that process. This is code for every side of cubes:

```
LoadTexture('yneg.jpg',EnvironmentBox[0]);
glTexParameterf(GL_TEXTURE_2D,
GL_TEXTURE_WRAP_S, GL_CLAMP);
glTexParameterf(GL_TEXTURE_2D,
GL_TEXTURE_WRAP_T, GL_CLAMP);
LoadTexture('ypos.jpg',EnvironmentBox[1]);
glTexParameterf(GL_TEXTURE_2D,
GL_TEXTURE_WRAP_S, GL_CLAMP);
glTexParameterf(GL_TEXTURE_2D,
GL_TEXTURE_WRAP_T, GL_CLAMP);
LoadTexture('zneg.jpg',EnvironmentBox[2]);
glTexParameterf(GL_TEXTURE_2D,
GL_TEXTURE_WRAP_S, GL_CLAMP);
glTexParameterf(GL_TEXTURE_2D,
GL_TEXTURE_WRAP_T, GL_CLAMP);
LoadTexture('zpos.jpg',EnvironmentBox[3]);
glTexParameterf(GL_TEXTURE_2D,
GL_TEXTURE_WRAP_S, GL_CLAMP);
```

```
glTexParameterf(GL_TEXTURE_2D,
GL_TEXTURE_WRAP_T, GL_CLAMP);
  LoadTexture('xneg.jpg',EnvironmentBox[4]);
  glTexParameterf(GL_TEXTURE_2D,
GL_TEXTURE_WRAP_S, GL_CLAMP);
  glTexParameterf(GL_TEXTURE_2D,
GL_TEXTURE_WRAP_T, GL_CLAMP);
  LoadTexture('xpos.jpg',EnvironmentBox[5]);
  glTexParameterf(GL_TEXTURE_2D,
GL_TEXTURE_WRAP_S, GL_CLAMP);
  glTexParameterf(GL_TEXTURE_2D,
GL_TEXTURE_WRAP_T, GL_CLAMP);
  LoadTexture('ball.jpg',Texture_ball,
false);
```

In this codes seen that every image is merged into variable `EnvironmentBox` with type of array which amount of cube is 6. The aim of this merging is to import side of cube into every cube. In other hand, this side is take placed with wrapping technic to handle texture which is overload the standard coordinate from OpenGl, which is 0.0 until 1.0.

4.1.2 Cube Environment Mapping

```
CubeMap_Define :  array[0..5] of TGLenum = (
          GL_TEXTURE_CUBE_MAP_POSITIVE_X_ARB,
          GL_TEXTURE_CUBE_MAP_NEGATIVE_X_ARB,
          GL_TEXTURE_CUBE_MAP_POSITIVE_Y_ARB,
          GL_TEXTURE_CUBE_MAP_NEGATIVE_Y_ARB,
          GL_TEXTURE_CUBE_MAP_POSITIVE_Z_ARB,
          GL_TEXTURE_CUBE_MAP_NEGATIVE_Z_ARB
          );
```

From that codes, we could see that codes preparing an environment to create dynamic cube mapping. Coordinate that has prepared is coordinate for cartesian(X,Y,Z) this is caused environment that wanted to make is environment in 3D form. Function of `GL_TEXTURE_CUBE_MAP` is for rendering in every sides which having positive or negative coordinate.

This is codes for preparing variable to receive textures in dynamic cube mapping: **var**

```
CubeMap_TEX : GluInt;
Texture_ball :  GLuint;
EnvironmentBox :  array [0..5] of GLuint;
```

This variable is used to receive objects's texture. Function of GluInt is initialization for GLAUT library. Function of GLUT is a interface program which using ANSI C and FORTRAN which interrelated Windows system which is not depend on OpenGl program.

5 Main Point Of Differences Dynamic Cube and Cube Mapping

In last sections, there have explained about means and aim of why there could create Cube Mapping and Dynamic Cube Mapping. In this part, aim to explain the main differences of Cube Mapping and Dynamic Cube Mapping which very seen from resulted of pictures in top, which are:

1. Dynamic Cube Mapping is development or enhancement of Cube Mapping

2. Lighting of Dynamic Cube Mapping is more look as real as than Cube Mapping

3. Object of Cube Map is static in other hand dynamic cube mapping is dynamic which means that environment of dynamic cube mapping could be changed but in static u will see that is no any changed.

4. Shape of mapping in dynamic cube is not look like cube caused changes of environment

5. Creating of dynamic cube mapping need cost more expensive than cube mapping which is caused amount of texture mapping must be rendered more than usual in cube mapping. And, this technic will more expensive if there is reflective of object in its environment.
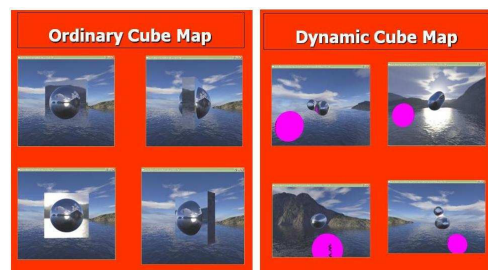

Figure 2. Dynamic Cube and Cube Mapping

6 Conclusions

Graphic Computer is field of knowledge which processing input of a media then processing that input. This input could be models or objects of pictures becoming an useful of information. Part of graphic computer which is problem in this paper is cube mapping which developed into dynamic cube mapping. Cube mapping has done in 2 technic Cube Map Environment and Texture. Beside that, is supported by application, using OpenGl then could be done 4 ways which are preparing environment for Dynamic Cube Mapping, running and non-activated Cube Mapping,

initialization variable for action in environment, rendering in every environment which every ways are ways in creating sphere mapping which is in kind of mapping have lack compared of Cube Mapping, that is only could see in 1 side. And from application, we could know that dynamic cube mapping is changes of 2D object becoming 3D object. Changes of 2D becoming 3D, dynamic cube mapping is used in creating film, advertisement, or games.

Cube Mapping is part of environment mapping which is divided into 3 parts, however there are 2 parts which connecting there are sphere and cube mapping. Main point which make it different is reflection of environment. So, in static cube mapping is environment which is reflected will not changed, in other hand dynamic cube mapping environment could changed its environment or the movement is very look real. Dynamic cube mapping is development of Cube Mapping which is there are differences on dimension, lightening, and texture.

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