

PROJECT: ILLUSTRATE YOUR HUASHAN: Advanced Web 3D Mapping and Collaboration Design System

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Abstract. This Project attempts to utilize the texture-mapping of characters from the video game industry, as well as real-time graphic in the internet and tablet device of wireless network environment, for the construction of a 3D cyberspace environment that local artists in Huashan could use to freely give expression to their creativity, and for the establishment of a personalized visual space where 3D users can engage in online discussions about collaboration design.

1. Introduction

Occupying an area of 7.2 hectares, Huashan Cultural and Creative Industry Center of the CCA (Council for Cultural for Affairs, Executive Yuan ROC) is located at the heart of downtown Taipei (Figure 1), on the site of the old Taipei Winery founded in 1916 (New Vision of Huashan, 2003). Thanks to the undisturbed industrial establishments and historical building clusters, it is now one of Taiwan's most significant centres for visual designs and performing arts, where artists find inspirations (Figure 2). In its effort to implement an environmental renewal plan to renovate the premises, CCA invites input of local artists in Huashan. According to Taipei City Government's Wireless City Project, the City of Taipei is expected to



Figure 1. The aeroview of Huashan District.



Figure 2. The visual art in the industrial establishment of Huashan.

become a wireless Internet city (Entrance of Taipei WLAN, 2004). The concept of this project involves invitation of local artists to link with Huashan through a tablet that enables them to log on anytime and anywhere they want to. In addition to the conventional connection, it is the author's desire to develop a collaboration design system that would allow them to change or create environments via digital media.

2. Texture-Mapping of Character Animation

For long, computer graphic has been extensively applied to 2 mainstream entertainment media—motion pictures and video games (Figure 3) (CG designer, 2001). The latter has been trying to catch up with the movie industry in terms of visual effect. But video games are more concerned about functional relationship between real-time rendering and the graphic card. The images of video games are far less delicate than that of movies, which have been put together frame by frame. As a result, how to develop more efficient real-time render algorithm for the game industry has become a very popular subject in the computer graphic domain.

For character animation, unwrap texture-mapping has been widely employed. It is a very delicate and effective mapping method that involves extremely low system cost. In principle it matches a polygon model with an image. No matter how delicate a model may be, all we need is one image file. This mapping method makes modification easy and is capable of real-time display of intricate mapping effect (Figure 4). At present high level 3D graphic software such as Maya, 3DS(3D Studio Max) and Softimage all have built-in basic mapping function like this (3DS 5 tutorial, 2002).



Figure 3. Real-time texture-mapping video game NBA 2001.



Figure 4. The unwrap map of character texture-mapping.

3. Java Applet

Developed by Sun Microsystems, Java is an object-oriented program design language like C++. It is favoured by numerous network engineers because of its much internet-friendly feature. With the rapid development of the Internet, Java's functions have

been enhanced so its powerful features, such as cross-platform operation, object-orientation, portability and Internet program design, are more expansively applied (Figure 5) (Gries, 2004).

The use of Java Applet in conjunction with ASP program enables us to modify the configuration of WEB database and upload/download the database. All users need is Java browsers such as IE (Figure 6). Through HTTP protocol we can embed powerful collaboration-design-compatible functions, such as videoconference, shared picture editor (e.g. whiteboard), file sharing and URL browser sharing, into the network system of this framework (Zewall, 2002).



Figure 5. Java 2D Graphic demo program.



Figure 6. The online 2D-painting website.

4. Objective

Observation of current Web 3D environments reveals that matured technologies are available for users to browse through visual space and for events to take place (Huang, 2001). With interactive communication mechanisms, 3D chat rooms also have attracted many patrons (Figure 7) (Aerosmith worldplayer, 2001). However, Web 3D requires advanced web technologies and program writing, so ordinary users just can browse through websites but cannot change the 3D environment when they are online (Chang, 2003). That limits 3D designers from sharing personal unique designs in the virtual space. Now combine the development of new texture mapping techniques and JAVA Applet, designers and users alike are looking into the possibility of how they can change 3D real-time environments and construct an online multi-user browsing system. Through this easy system, users can get to utilize unsophisticated graphic interfaces (e.g. Microsoft mspaint.exe) (Figure 8) to change 3D environments and engage in multi-user collaboration virtual space design.

Hence, the objective of this research is to study how to apply ripe programming language and technique in the Web 3D simulation to reach the high level real-time virtual environment. In order to enable users using the simple system to combine the relations between their design works and the 3D environment the in Internet with other users, and at the end, to present the interactive mechanisms the same as video game.



Figure 7. Online 3D chat room.



Figure 8. Simple Window's painting software: mspaint.exe Aeromith worldplayer.

5. Methodology

This research is focused on applied media. The methodology is shown as follows:

5.1. INTERFACE CONSTRUCTION STAGE

In the first, the research utilizes Java Applet to embed webpage functions and program writing codes. It is mainly for website image modification and drawing. Take bitmap.exe, a simpler built-in software of Windows, for example. Its frequently used functions include RGB modification, repeated pasting, pattern adjustment and so on. We can examine the basic function and source code of this software and transplant its concept and use to the WEB via Java language (Figure 9). Through Java's cross-platform capacity for webpage images, Java Applet can become the server system for the Internet for dynamic image modification (Figure 10) (Kelly, 1998). Users will find it very convenient for personal creative works.

```
abstract void copyArea(int x, int y, int width, int height, int dx, int
abstract Graphics createG()
Graphics createG(int x, int y, int width, int height)
abstract void allocate()
void draw3DRect(int x, int y, int width, int height, boolean raised)
abstract void drawArc(int x, int y, int width, int height, int startAngle
void drawBytes(byte[] data, int offset, int length, int x, int y)
void drawChars(char[] data, int offset, int length, int x, int y)
abstract boolean drawImage? file esadono varie versioni
abstract void drawImage(int x1, int y1, int x2, int y2)
abstract void drawOval(int x, int y, int width, int height)
abstract void drawPolygon(int[] xPoints, int[] yPoints, int nPoints)
void drawPolygon(Polygon p)
abstract void drawPolyline(int[] xPoints, int[] yPoints, int nPoints)
void drawRect(int x, int y, int width, int height)
abstract void drawRoundRect(int x, int y, int width, int height, int
```

Figure 9. Source code of online painting Java Applet.



Figure 10. Interface of painting Applet prototype.

5.2. SIMPLE MODEL STAGE

To maintain and optimize smooth running of the system, we utilize 3DS to build a simple Huashan Building Mass Model for texture mapping in the future (Figure

11). In this step, the simple building mass model will extrude the basic scale from the elevations as basic objects for pasting (Figure 12). In the next step, we will introduce an effective solution, which employs ordinary pasting method on 3DS, for rendering of architectural details and materials.

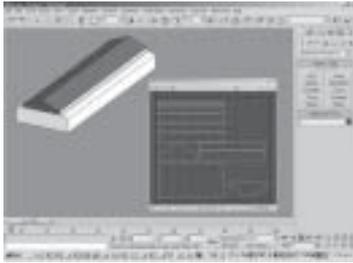


Figure 11. The dummy house built for next step's mapping.

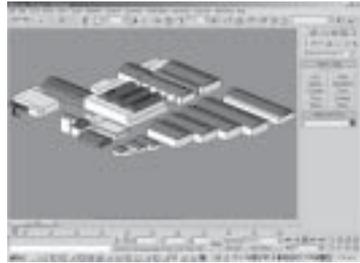


Figure 12. The total historical buildings of Huashan.

5.3. UNWRAP MAPPING STAGE

In this step, the 3DS (3D Studio Max) “unwrap UVW mapping” function in this project is similar to character texture mapping of video games (Figure 13). In 3DS, designers only need to unfold 3D model to fit for 4 aspect elevations (Figure 14), and 3DS will automatically generate the textured model for well mapping and export it to Web 3D format (ex: .wrl, .w3d) (Figure 15). It is no longer required to break down the picture of each polygon into tiny picture files and lower the threshold and website storage space.



Figure 13. The gray 4 aspects elevations as mapping-texture.



Figure 14. The flatten mapping of unwrap function in 3DS.



Figure 15. The textured model after unwrap mapping.

5.4. SYSTEM INTEGRATION STAGE

As far as system integration is concerned, the researcher now applies JAVA Applet on website's interface to alter maps (Figure 16) (Hardy, 1999). Users can through the simple graphic command on the website apply wireless tablets to the elevations mentioned above with personalized crayons and sketches (Figure 17). This 3D environment will have real-time update with the changes by altered elevation maps

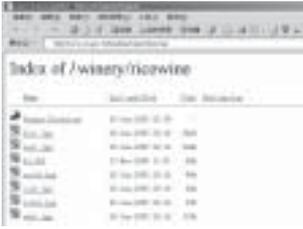


Figure 16. The ASP website of texture-mapping image database.



Figure 17. To draw personal imagination with the tablet.



Figure 18. The virtual Huashan district after painting by artists.

(Figure 18). Eventually, this system will allow multi-users to browser the same space at the same time and engage in collaboration design pertinent to the space astrosphere.

6. Project

This project is about an advanced web 3D system developed according to the methods mentioned above. The researcher developed a virtual space that allows users to update the mapping environment online (Figure 19). “Huashan Park Short-Term Circuit & Network Establishment Project” designed by Council for Cultural Affairs is about to be completed by the end of 2004 (CCA). In August 2005 this project will begin its online operations. At present it is going through test stages. In order to adjust HCI (Human–Computer Interface) and accessibility of this system, the researcher continued to invite users not in the space-related profession to use the system and offer comments. The way local artists, who are not used to experiencing space sensation of Huashan through the screen (Figure 20), operates the system is also observed for optimization of the most appropriate process.



Figure 19. The web 3D browser of Huashan (entrance).



Figure 20. The web 3D browser of Huashan (aeroview).

It is the researcher’s earnest hope that those artists, who have been accustomed to expressing their opinions through paintbrushes, get to share 3D Huashan’s ideas

via updated media technologies. Through this visualized 3D collaboration design platform the government and local artists will be able to exchange their thoughts and comments on future development of Huashan (Figure 21). It will become one of the best communication media for the government and the academic circle, as well as those who are concerned about this issue (Figure 22). It enables nonprofessionals in Huashan to express their space imaginations through a simple interface. And these also demonstrate that the research and methods are reachable and highly interactive virtual spaces that designers have never seen.



Figure 21. The web 3D chat room in virtual Huashan I.



Figure 22. The web 3D chat room in virtual Huashan II.

7. Conclusion

7.1. SIGNIFICANCE

The significance of this research project lies in its attempt to set up a collaboration system for laymen such as local artists in Huashan, who are interested in environmental renewing, to design their own 3D environment, and to construct a 3D virtual platform for them to engage in online discussions. Utilizing the game industry's real-time texture mapping of characters, as well the high accessibility of JAVA Applet in website graphic design, it can more successfully express the 3D space in artists' imagination.

7.2. LIMITATION

As far as limitation is concerned, to achieve the symmetrical requirement of mapping the details and polygons of 3D models may have to be reduced. During system test run, the researcher discovered that the way artists use digital tools is very different from that of space professionals who are familiar with 3D software. How to shorten the time required for training is something we need to work on.

7.3. FUTURE STUDY

Future study may work toward incorporating GPS (Global Positioning System) in the system to enable users to make real-time changes to the mirror virtual space on the tablets near by hands as they around the Huashan center (Figure 23). Perhaps we can incorporate the “2-Wireless-AP (Access Point) Positioning Technique” (which is being studied for improvement of accuracy) and determine users’ location via wireless signal strength algorithm (Figure 24) (Ergen, 2002). To lead the standstill situation of Web 3D environment in the design domain forward to the much more lifelike reality and rituality combination standard.



Figure 23. Walk around the Huashan by.



Figure 24. 2-Wireless AP Positioning Technique.

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