Research on the Application of Digital Application Technology in Computer Vision Communication Design

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Abstract. With the development of computer technology, new changes have appeared in the design of computer graphics and images, and more attention has been paid to visual communication, and the connection with visual communication design is getting closer. The article analyses the design of computer graphics and visual communication. After that, the computer image visual communication system is designed and the function of this system is analysed. Finally, the designed computer graphics visual communication system is tested. Through experimental analysis, the packaging designed by this system has good visual communication and perspective effects.

Keywords: Digitization; Computer; Visual communication; Image processing system.

1. Introduction

Digital information technology is growing rapidly at the end of the world, and has made great progress and development. The vigorous development of computer technology has caused earth-shaking changes in many areas of social life. This has also enabled computers to be used as a basic and fast tool in many areas, such as product development, business management and other social activities. With the development of computer technology, computer graphics and image design has also made a qualitative leap, which also provides new ideas and possibilities for visual communication design [1]. This paper proposes a design method of plane visual communication based on user experience effects. First, carry out the image sampling analysis of the plane visual communication; then carry out the feature extraction and visual information reconstruction of the plane visual communication design, and realize the plane visual communication design according to the user experience effect. Finally, the simulation experiment analysis shows the superior performance of the method in this paper in improving the effect of plane visual communication design.

2. Computer graphics design and visual communication design

For people in the modern visual communication era, digital art has penetrated into people’s daily lives. It is a more popular way of artistic creation. Most young people like to try it. Using this method can release their own imagination [2]. And to effectively express one's own mood. Computer graphics design and visual communication design release not only the hands of designers, but also make their brains flexible, freeing their bound imagination, not just limited to the technical framework, and can create unconscious and supernatural Special works, this aspect is also the advantage of computer graphics design and visual communication design. Figure 1 shows the image collection structure designed by computer graphics images (picture quoted from BIM and Energy Efficiency training requirement for the construction industry).

Visual communication refers to the use of vision to realize the design of information dissemination. Each item uses its colour, shape, gloss, size and other visual symbols to convey content, and then spreads to the group through the individual, and the group can also spread to the group. So as to meet its communication design purpose. It can use a series of media such as television, newspapers, magazines, etc. to express its design concepts and share it with the public.

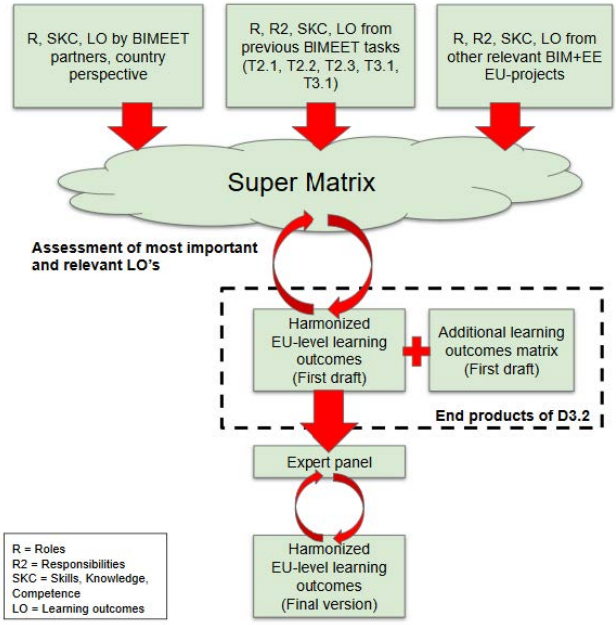

Figure 1. Image collection structure of computer graphic image design

3. Design of digital system for visual communication based on CAD-assisted technology

3.1 The overall framework of the system

The system in this paper is designed with a central control structure system. Model display and user interaction are realized through the user layer. Shared objects are set on the server. The modelling model is provided by the server to complete the shared model. Collaborating members obtain results through broadcast [3]. The overall framework of the system is shown in Figure 2 (picture quoted from Development on CAD/CAPP Parametric Design System of Tra in Axle).

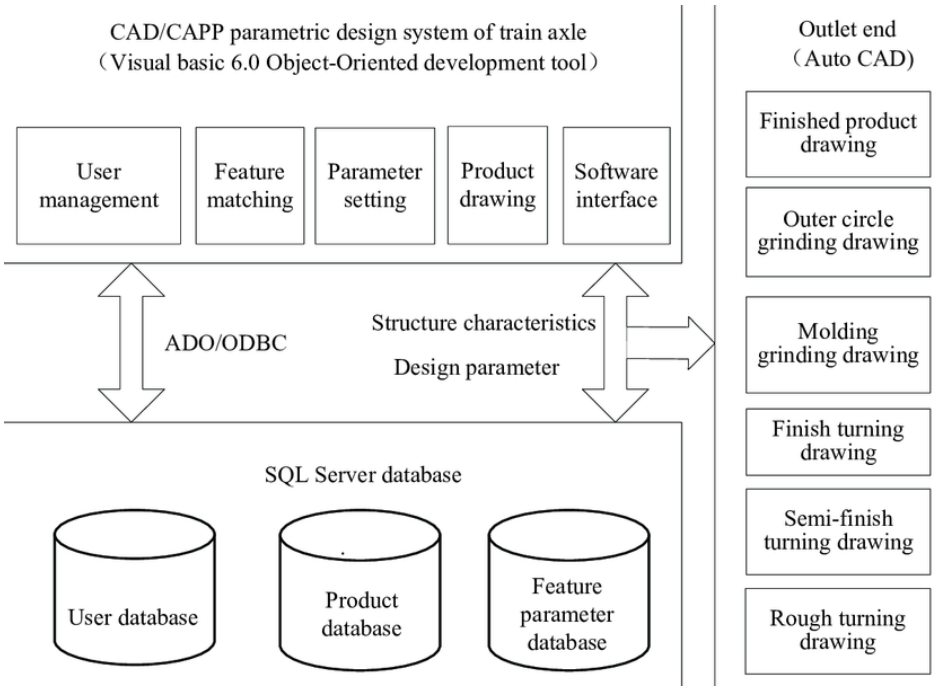

Figure 2. The overall framework of the system

In this system, the user layer is mainly responsible for interactive operations, the communication service module is responsible for transmitting information between the server and the client; the collaborative agent module is mainly responsible for group awareness and working with other functional modules [4]. The packaging retrieval module is connected to the data management module in the application layer in the background to realize the classified retrieval of packaging materials and parts and preview the retrieval results; the CAD graphics module creates a human-computer interactive operating environment, and the back-end connects the file I/O module and the data management module to each other. Convert the I/O of the standard file and store the package shape in the database.

The application layer is responsible for realizing the main functions of the system. The communication management module coordinates the communication distribution when designing the packaging, realizes the directional forwarding and sending of information on the server, and can establish or tear down user connections; the collaborative management module realizes the interaction among members when modelling tasks occur. Concurrency control, session management, communication forwarding and consistency maintenance.

The communication module in the service layer realizes the connection and data interaction between the user layer and the service layer; the publishing module is responsible for publishing system dynamic information on the Internet; the user management module is responsible for user registration information and realizing identity verification, as well as authority management. Each module in the database layer is responsible for storing data information parameters and so on.

3.2 Realization of visual communication

Three-dimensional motion estimation refers to the estimation of three-dimensional motion parameters and three-dimensional structure of an object from a two-dimensional image sequence. Specifically, assume that a point M on a three-dimensional object moves from position (x_k, y_k, z_k) at time t_k to position $(x_{k+1}, y_{k+1}, z_{k+1})$ at time t_{k+1} relative to the camera coordinate system, and its projection on the two-dimensional image plane moves from (x'_k, y'_k) to (x'_{k+1}, y'_{k+1}). Then, through analysis Two-dimensional motion to restore the three-dimensional motion of the object and the depth value of the point of interest on the object. This is similar to the depth recovery of stereo vision, but the stereo vision is to recover the depth value from the stereo image pair, and the three-dimensional motion analysis is to recover the parameters from the image sequence.

Assume that there is a rigid object in the three-dimensional scene. The point M on it rotates and translates from the position (x_k, y_k, z_k) at the time t_k to the position $(x_{k+1}, y_{k+1}, z_{k+1})$ at the time t_{k+1}. Suppose the rotation matrix and the translation vector are $\mathbf{R}_k$ and $\mathbf{T}_k$ respectively, then the three-dimensional rigid body motion model is re-expressed as

$$\begin{pmatrix} x_{k+1} \\ y_{k+1} \\ z_{k+1} \end{pmatrix} = \begin{bmatrix} r_{xx} & r_{xy} & r_{xz} \\ r_{yx} & r_{yy} & r_{yz} \\ r_{zx} & r_{zy} & r_{zz} \end{bmatrix} \begin{pmatrix} x_k \\ y_k \\ z_k \end{pmatrix} + \begin{pmatrix} t_x \\ t_y \\ t_z \end{pmatrix} = \mathbf{R}_k \begin{pmatrix} x_k \\ y_k \\ z_k \end{pmatrix} + \mathbf{T}_k \tag{1}$$

The above rotation matrix is expressed in the form of Euler angles and assuming that the rotation angle is small, the rotation matrix can be expressed as

$$\mathbf{R}_k = \begin{bmatrix} 1 & -\phi & \psi \\ \phi & 1 & -\theta \\ -\psi & \theta & 1 \end{bmatrix} \tag{2}$$

Among them, θ, ψ, ϕ respectively represent the small angular displacement of counter clock wise rotation around the x, y, z axis. Let the projection of the space point (x, y, z) on the image plane be (x', y'). If the imaging model is an orthogonal projection (see Figure 1.8), there is

$$x' = x \; y' = y \tag{3}$$

Therefore, formula (1) can be expressed as

$$\begin{aligned} x_{k+1} &= x'_{k+1} = r_{xx}x'_k + r_{xy}y'_k + (r_{xz}z_k + t_x) \\ y_{k+1} &= y'_{k+1} = r_{yx}x'_k + r_{yy}y'_k + (r_{yz}z_k + t_y) \end{aligned} \tag{4}$$

The above equation contains 6 parameters, namely r_{xx}, r_{xy}, r_{yy}, r_{yx}, $(r_{xz}z_k + t_x)$ and $(r_{yz}z_k + t_y)$, which represent the affine mapping relationship from the image pixel (x'_k, y'_k) of the k frame to the image pixel (x'_{k+1}, y'_{k+1}) of the $k+1$ frame. Obviously, the orthogonal projection model is unable to determine the distance between the object point and the imaging plane, because a straight line perpendicular to the image plane, all points on it will be projected to a point on the image plane. However, if a reference point is selected on the object and the depth value of the point is set to z_{ref}, it is possible to estimate the distance z_{rel} of other points on the object relative to this reference point in the direction of the vertical image plane through the above formula. In fact, we cannot get the true relative depth value, only the relative depth value about a scale factor α, namely

$$z = z_{ref} + \alpha z_{rel} \tag{5}$$

From Equation 4, we see that r_{xz} and r_{yz} reduce α and z_k enlarge α, the equation still holds, so ambiguity arises.

4. System board design

4.1 Image collection

Use the image collection card and LabVIEW7.1 to realize the design of the image collection module. Figure 3 shows the structure of the system image collection module. The image collection board is mainly used to realize the A/D conversion process of the standard video signal [5]. After that, the data is quantified and the PCI bus is used to connect to the computer. Passed in the memory RAM, realizes the image collection and stores the image through the NIMAQ control function image collection card.

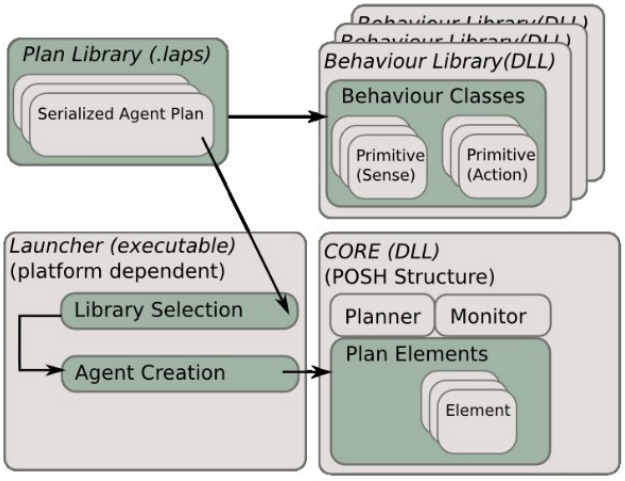

Figure 3. The structure of the system image collection module

4.2 A/D conversion module

Use CCD camera to realize image collection. Figure 4 shows the functional structure of the A/D conversion module. The processing result of the luminance signal is sent to the chrominance signal processor to realize the comprehensive processing, thereby generating the YUV signal, generating the RGB signal through the transformation matrix, setting the control register, and realizing the output of the corresponding format data through the VPO. Make all the way into the synchronization

separation circuit to generate the field and line synchronization signals VS and HS through the digital PLL, and the PLL drive clock generator can generate the HS lock clock signal.

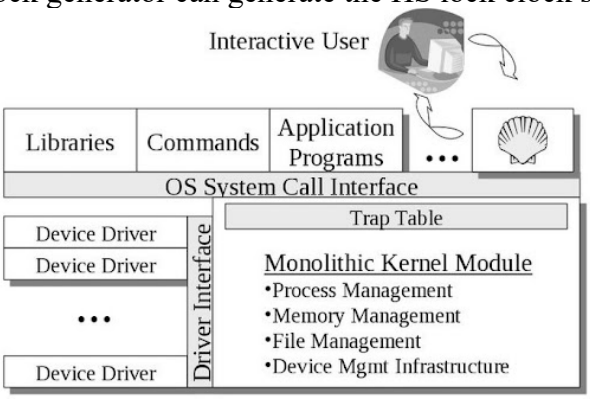

Figure 4. Model structure of the image segmentation module

4.3 Illustration and painting design

In the computer image graphics processing technology, the painting function and the toning function are one of its characteristic functions, and many designers use this function to carry out the painting design. In this process, the painter first needs to draw a draft, and on the basis of the draft, use computer image and graphics processing technology for artistic processing. With the continuous improvement of computer technology, the colour toning function of image design work has been continuously strengthened [6]. In addition, the complicated operation steps related to graphics processing technology have become simple, so it has been widely used. The application of illustration and painting design in computer graphics and image technology to the visual communication system enables designers to perform subsequent artistic processing of visual effect design work, effectively saving the time of art designers, and improving the efficiency and efficiency of visual communication design work. Speed, in addition, also provides rich expression content for visual communication design work.

5. System Test

The simulation experiment of plane visual communication design is established in the Matlab7 experiment platform. The pixel set of the original plane visual communication image sampling is a 500×500 JPEG image, the matching value of the block template is 25×25, the gray-scale neighbourhood distribution threshold is ε=1.0, and the average gray value is set to F=24Pixel, the aperture size for visual imaging is 14mm. According to the above-mentioned simulation environment and parameter settings, the initial outline of the planar visual communication design is shown in Figure 5.

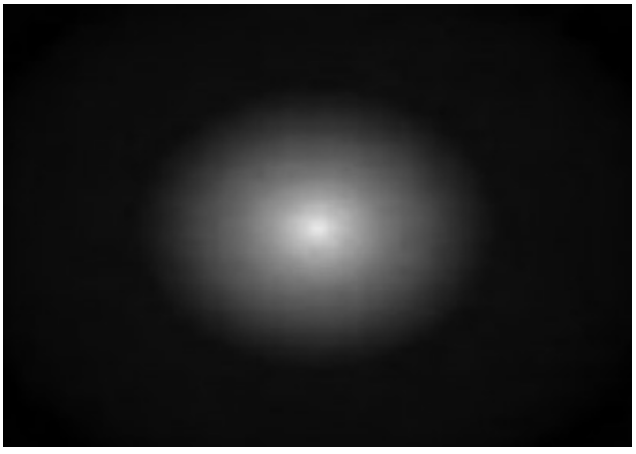

Figure 5. The initial outline of a flat visual communication design

According to the initial edge contour detection results, the user experience effect evaluation model of the graphic visual design image is established, and the graphic visual communication design is realized according to the user experience effect. After multiple iterations, the design effect obtained is shown in Figure 6.

Figure 6. Graphical visual communication design effect

6. Conclusion

The research in this article shows that the progress of science and technology belongs to the main ideal of national progress. In the modern era of diversified development, the combination of computer graphics and image processing technology and communication design has been widely used in various industries. This paper realizes that the computer graphics vision system can realize the innovation of the traditional computer vision system, so that the computer graphics technology can effectively enrich the system, and effectively combine computer graphics and visual communication technology to provide the accuracy of image processing.

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