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Visual Packaging Communication in Virtual Reality System

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Abstract: Virtual technology is a very hot high-tech in recent years, with the rapid development of virtual technology, now virtual technology products have been everywhere around us. Visual communication technology is one of the core technologies in virtual technology imaging system. Visual communication technology is a mature technology developed for many years. Among them, the visual packaging communication technology is the most widely used, which is an indispensable part of commercial life and product promotion. But at present, the research on the combination of virtual technology and visual packaging communication technology is almost blank. In order to fill the gap in this field, this paper proposes the research of visual packaging communication design based on VR system. The research of this paper is mainly divided into three parts. The first part is the research of basic theory and core concepts, which provides a solid theoretical basis for the subsequent system construction and experimental testing. Through the research and analysis, this paper believes that the rapid development of virtual technology, mainly with its realistic simulation effect, has brought a new breakthrough for the field of e-commerce and game. The second part is the design of VR system. The system design of this paper is based on the optimization and upgrading of traditional system, the main core is packaging communication technology, and through modeling and other technologies to further optimize the effect. The system also adopts the latest optical design to enhance the user experience. The third part is the simulation experiment. Through the simulation, the performance of the system is tested. Through the test and analysis of the experimental data, we can see that the system in this paper is in good running state, with high stability, and its content load has also been breakthrough.

1. Introduction

Virtual reality (VR) is a modern high-tech technology with computer technology as its core. It uses VR helmet or multi projection environment, and sometimes combines with physical

environment and props equipped with sensors to generate realistic images and sounds in the virtual environment to simulate the real existence of users. People using VR devices can use high-quality virtual technology to "look around" the virtual world, move in the virtual world, and interact with virtual functions or virtual objects. This effect is usually to create and implement VR headphones. It contains a head mounted display to generate a two-dimensional display of the enlarged image. Through an optical system, the image is collimated to infinity or far enough away to create a screen effect of several meters or even tens of meters away. However, this effect can also be achieved by special design space with multiple large screens. In the era of rapid development of science and technology, VR technology is also developing rapidly, which is applied to military simulation, car driving, 3D game entertainment, 3D film production, virtual teaching and other industries. As the virtual environment or scene of VR technology is mainly generated and controlled by computer, its implementation process is closely related to graphic and image design technology and visual communication design technology.

Visual communication design is a practical art form full of artistry and economy. On the one hand, as the main body of art design, its primary purpose is to create visual beauty, which is the expression of its artistic characteristics. On the other hand, its value can only be reflected in economic activities, which is the full embodiment of its economic characteristics. With the establishment and improvement of China's socialist market economic system, the development and prosperity of visual communication design has a strong economic foundation. Visual communication design belonging to superstructure can also respond to economic development. With the continuous expansion of social needs and the continuous improvement of human spiritual civilization and aesthetic taste, people in the new era put forward higher requirements for visual communication design. It is not only the commercial advertisement design, packaging design and brand enterprise image recognition system to promote brand and promotion products, but also products closely related to market economy and visual communication design. As a comprehensive design category based on science and technology, visual communication and information transmission, visual communication has increasingly become a powerful means for local and enterprise economic development. People have realized that good visual communication design can greatly promote the promotion and sales of products, drive the industry with products, and drive the development of local economy by industry.

At present, the most widely used visual communication design is packaging visual communication design, which plays an important role in various commercial activities and product promotion, and is also the main source of people's first impression. At present, the development of virtual technology makes the role of visual communication design better play, but there is little research on the visual communication design of packaging in the virtual technology. The mainstream research is combined with visual communication design. In order to make up for this deficiency, this paper puts forward the related research of traditional visual packaging design based on VR system. The purpose is to combine virtual technology with traditional packaging design technology, so that the packaging industry can get further technical improvement.

First of all, this paper makes an in-depth study on the basic theory of virtual technology and visual communication. Through the research, this paper thinks that virtual technology can be widely used in many production and life fields because of its realistic simulation ability. Visual communication technology is an important part of the image plate in virtual technology, which directly affects the user's experience. Therefore, it is of great significance to enhance the integration of the two and give full play to each other's advantages. Through the research of theoretical knowledge, it provides a solid theoretical basis for the follow-up VR system development. The VR

system designed in this paper mainly takes the visual packaging communication technology as the core, and makes full use of the packaging communication technology through rendering, modeling and other technologies. In order to enhance the user's experience, optical design is added to the system. Through the optical design, the focus of the user can be adjusted automatically to get the best viewing experience. As for the specific methods of packaging modeling, this paper also gives a detailed explanation in the third chapter. In order to verify the actual performance of the VR system in this paper, a number of simulation experiments including control accuracy, response time and so on are carried out at the end of this paper. Through the analysis of the experimental data, we can see that the VR system in this paper has good comprehensive performance, which has reached a higher standard. This experiment has achieved ideal results and made a contribution to the research of virtual technology and visual packaging communication technology [1-3].

2. Virtual Technology and Basic Theory of Visual Communication

2.1 VR Technology Concepts

In short, VR is a new way for people to visualize and interact with complex data through computer. Compared with traditional man-machine interface and popular window operation, VR has made a qualitative leap in technical thinking. "Reality" in VR refers to anything or environment existing in the world in physical or functional sense. It can be realized, it can be difficult to achieve, or it is impossible to achieve at all. "Virtual" refers to the computer generated; therefore, VR refers to a special environment generated by the computer. People can "project" them into the environment through various special equipment, operate and control the environment, and achieve a special purpose, that is, human is the master of the environment.

VR is essentially an advanced computer user interface, which provides users with visual, auditory, tactile and other intuitive and natural real-time perceptual interactive means to maximize the user's operation. According to the different application objects of VR technology, its functions can be expressed in different forms, such as some conceptual design or visualization and operability of concepts, realization of real remote control field effect, realization of cheap simulation training in any complex environment, etc.[4-6].

2.2 Main Features of VR Technology

The key technologies of VR mainly include: dynamic environment modeling technology, real-time 3D graphics generation technology, 3D display and inconsistent sensor technology, application system development soil tools, system integration technology. VR has the following main features:

(1) Reality

It refers to the degree to which users feel that the protagonist is in the simulation environment. An ideal simulation environment should make it difficult for users to distinguish the differences.

(2) Multi perception

In addition to visual perception, ordinary computers also have auditory perception, tactile perception, motion perception, and even taste, smell, perception, etc. an ideal VR should have the perception function and sense of existence owned by everyone.

(3) Interactivity

Interactivity refers to the extent to which users operate objects in the simulation environment and the natural degree of users' feedback from the environment. It is mainly reflected in the industrial

design based on VR technology. Virtual 3D digital model is used as the main carrier of information to ensure the cooperation of many people. Use digital models and VRI / 0 devices (audio, helmet, data glove, tracker, etc.) to generate the virtual world of products. Among them, we combine the equipment with the given simulation object, and act on people through vision, hearing and touch, so that people have the feeling of immersive. All of our behaviors are embodied in the digital model, in which we communicate with others and with machines. It connects consumers, manufacturers and designers on one platform and integrates design, engineering and consumption into one system. Before the product is actually manufactured, designers and engineers should first see the production of digital prototype in a specific virtual manufacturing environment. Designers, engineers and marketing personnel jointly predict and evaluate its appearance, performance and market potential [7-9].

2.3 Concept of Visual Communication Design

"Visual communication design" appeared in the 1960s and has been continuously extended by graphic design. It refers to the modeling design that conveys information through visual means, that is, "design for people to see". In the rapid development of information society, the traditional print media has been unable to meet people's communication needs, graphic design cannot cover the design activities based on emerging media, and so the word "visual communication design" is more scientific and reasonable, more in line with the development trend of design. From the development of visual media and people's visual way, visual communication design includes not only all the contents of graphic design, but also information design activities centered on modern electronic media, such as image design, digital media design, network design, etc. No matter what kind of visual communication design, it is not a linear, one-way information expression, but a communication and interaction behavior based on the combination of modeling, appeal and understanding.

In China in the 1980s, some people translated the imported "graphic design" into "visual communication design". We usually translated it into "graphic design". This shows that the understanding of visual communication design and graphic design at that time was very close. The essence of graphic design has not changed, but with the change of people's visual style and the emergence of new media, its connotation is also constantly expanding and evolving. In the era of consumption, graphic design, with its direct, extensive and penetrating communication mode, has become an important means of commodity circulation media and commercial publicity [10-12].

2.4 Change of Visual Communication Design

Visual communication design is the product of historical precipitation. The formation of different design styles is the result of social, political, economic, technological, cultural and other factors. The development of science and technology has an immeasurable role in visual communication design. Printing technology is a necessary condition for the existence and development of visual communication design. Printing characters and graphics on paper or other materials provides the possibility of information transmission. The invention of Chinese papermaking and printing is an important step in the history of visual communication design. In 1450, the first book of European printing, the appearance of German Gutenberg metal characters, created the way of "mass production", which enabled visual communication design to transmit information to the public, and opened the visual communication design in the printing age. Then, at the end of the 18th century, the invention of lithography led to the prosperity of commercial posters in the mid-19th century,

known as the media of graphic design. In the 1920s and 1930s, the application of photography technology in plate making greatly improved the effect of color printing. The development of printing technology and the material conditions provided by the industrial revolution have promoted the information age of mass production, commodity and information production.

With the development of society and the arrival of the digital age, visual perception has become the main sense organ, and the symbol system of hearing and touch has been added. The media has expanded from printing and video to multimedia, and the mode of communication has changed from single information transmission to interactive information transmission. The scope of visual communication design has become more extensive, from two-dimensional space plane design to three-dimensional space design and four-dimensional time design. The emergence of this colorful visual information indicates the arrival of a new era [13-14].

2.5 Definition and Elements of Packaging Visual Transmission Design

Visual communication design of packaging refers to the design and reasonable configuration of visual elements such as commodity packaging, text, color, picture or description, so that enterprise information, ideas, or commodities want to convey information to consumers, consumers and visual impact effect, so as to achieve the purpose of publicity and promotion. Visual elements refer to the basic units such as space, shape, texture, light, etc., which constitute visual objects, including concrete and abstract aspects, reflecting the relationship between the whole and the local. Visual elements are the tools and media for receiving and transmitting information, as well as characters and symbols of visual language. In packaging design, even if the information positioning is accurate and the selection and use of visual elements are improper, the information transmission will be affected and the object receiving the information will be misunderstood and confused. As visual elements, graphics, color, three-dimensional modeling, materials, trademarks, and words play the most basic role in the communication of the overall image of packaging, and can reflect the characteristics of most information symbols.

Packaging visual communication design belongs to the category of packaging spiritual function design. Based on the pertinence of this paper, its visual communication elements mainly include inappropriate and reasonable allocation of trademark, text, color, photo, illustration and other visual elements [15-16].

3. Visual Packaging Communication Design Method Based on Virtual System

3.1 Render Pipeline Flow

Commonly referred to as the rendering pipeline, it is a series of data processing processes that convert the data of the application into the final rendered image. The geometry vertex and attribute data are first set in the application client, and then the data is input into a series of shader stages for processing. The output of the elements will be input to the next stage to produce images that can be presented on the 2D screen. The drawing pipeline can be divided into several main stages: vertex processing, rasterization, wafer processing and output integration operation.

In the vertex processing stage, the vertices and primitives stored in the buffer are subjected to various corresponding processes, such as conversion operations. The rasterization stage is that the updated elements are transferred to the rasterization unit after cutting and each element is converted into a set of chips. Here, a piece of data is defined as a set of data that can be placed in the pixel frame cache, but may eventually be deleted and updated in the color buffer, which is defined as a

memory space to store pixels displayed on the screen. In the rasterization stage, the chip test is mainly carried out, and then the color value of the slice is determined through the slice shaders and various operations. In the output merging phase, pixels in the color buffer are compared or merged to update the color values of pixels [17-18].

3.2 Optical System Design

Because the fixed focus optical system has magnification when adjusting visibility, it cannot guarantee the consistency of binocular images, which makes the viewer prone to vertigo and even double images. Therefore, in view of the shortcomings of the existing technology, we propose an optical implementation method, which can effectively ensure the consistency of binocular magnification. This design also aims to provide an optical system to effectively ensure the consistency of binocular magnification, which can be matched with ordinary smart phones. The structure of the optical system consists of three lenses, two of which are glass balls (environmentally friendly and relatively cheap glass), and the other is COC optical plastic lens with uniform aspheric surfaces on both sides.

In the design process, several key parameters are selected and set

(1) The distance of exit pupil was 1 mm;

(2) The diameter of exit pupil was 15 mm;

(3) The range of diopter adjustment was 0-800 degrees, and the image quality was the best (most popular) when the myopia was 300 degrees;

(4) The field of view angle is set according to the screen size of commonly used mobile devices in life, as shown in Table 1.

Table 1: list of fields of view angle of adaptive display

mobile screen	5 inch half screen	5 inches 16:9	5-inch flip screen
Diagonal half field of view	42 degrees	32 degrees	35 degrees
Equivalent 0.5m display	35 inches	25 inches	29 inches
Equivalent 3M display	215 inches	140 inches	170 inches

In the binocular system, the monocular system uses a set of zoom lens group, and the zoom lens group uses two sets of lenses. In the zoom process, the distance between the node plane of the whole optical system and the two-dimensional display screen remains unchanged or changes little. The light is emitted by the two-dimensional display screen, passes through the first lens group, the second lens group, and then reaches the human eye. In order to make the overall size of the whole optical system constant or small change, and make the optical system have a large amount of visibility adjustment, the absolute value of the second lens group is more than 2 times of the absolute value of the first lens. The overall dimension is the distance between the second lens group and the two-dimensional display screen. The second lens group is mainly used to carry the optical power of the optical system, and the second lens group is mainly used to adjust the visibility and correct the aberration. The optical elements of the first lens group are crescent shaped lenses with aspheric refraction surface; the second lens group can be spherical or aspheric; the second lens group can be single lens or double glued lens with positive optical power [19-20].

3.3 Two Dimensional Visual Design of Packaging

Packaging two-dimensional visual design is based on the structure of the three-dimensional model of packaging, the graphic, text, color and other elements of the three-dimensional packaging model design, and the three-dimensional cartons model and packaging container model for two-dimensional map design. The design of 2D map is completed in Photoshop. It can be used for drawing and arranging.

(1) Square box design

The concrete drawing method of square box is to arrange the visual elements such as graphics, text, and color and so on according to the correct size ratio on the structure position on the unfolded drawing of the packing box. In this way, after the 3D model is made, the model can be accurately mapped through UV map positioning to complete the 3D packaging design, and PS software layout is selected here.

(2) Cylindrical vessel design

The lively and interesting design elements of the container are in line with the visual effect of the design. First of all, draw a variety of element graphics, in the layout according to the law of formal beauty, through the change of color combination to form color series, showing different styles of products.

(3) Changeable modeling design

Special care should be taken when designing maps for various shapes, because the shapes are irregular, the layout must be accurate, and the design of modeling structure should be reasonable.

(4) Other modeling design

In other modeling design methods, the grid tool is mainly used to draw the layout of graphic elements according to the alignment track.

3.4 3D Model Design

Model analysis: the structural design of carton and the design of container are the most important and important modeling contents in packaging design, and the modeling structure of cartons is rich and various. In addition to geometric shape, there are many special-shaped boxes. In the traditional three-dimensional packaging visual design, square box, column box and deformation packaging are mainly selected. The model was made by 3DMAX software. The length, width and height of the product were designed according to the precise data of packaging design.

(1) Square box model

The first is to create a box of the same size and shape in the standard primitive's panel. Because of the thickness of the box, the corners are curved, which is called chamfering in 3DMAX. In edit mode, execute face editing mode, select the top face of the model, find the bevel command in the edit panel, and chamfer the model face. After chamfering, mirror copy. Copy the bottom half of the model and manually zoom to make sure the box is 2-4% smaller than the top to get the shape we want.

(2) Cylindrical packing container model

It consists of a cylinder and a cover, which makes the barrel shape from the standard primitive panel called a tube. In the online editing mode, select the bottom surface of the model, select an edge of the bottom surface, select the loop command to obtain all the lines of the inner edge, and keep zooming until all the lines become a point, and finally make a chamfered cylinder. Make charmfercy1 from the expanded primitive panel to the desired end shape.

(3) Multi variant packaging container model

The multi dosage form packaging container includes a conical body part and a special-shaped

cover part. The cylindrical shape is created by using the standard primitive panel, the nodes are edited, the scale and movement are moved, the abnormal shape is analyzed, the node position is adjusted, and the general external surface is completed. The outer surface is smoothed by meshsmooth, and the smooth shape is obtained.

After modeling in 3DMAX, we need to use the material map to locate the model, which can not only paste the map correctly, but also add the standard size design map of the same modeling structure to the system in the future. Through interactive control, the model can be replaced by a map. The method is to edit the plot object uvws to align the model map to a reasonable position. For the uvws editing of packaging map, taking the box as an example, other modeling uvws editing methods are similar.

3.5 Object Recognition

In Virtools, there are hundreds of BB modules in Virtools, which are very convenient for users to drag and drop. In order to realize the target recognition function, it is necessary to add 2dpick module to many modules. It can capture the object touched by the mouse and return its name, 3D coordinates, normal vector and other information. Because of the partition board of the body, the seal and the box at the bottom of the 3D mathematical model, each partition is regarded as an object, only the name of each object needs to be changed, and the corresponding partition information needs to be displayed in the menu.

3.6 Interaction Design

This research is based on the hand feel control technology of UI design, so the user's gesture behavior is particularly important. The design process needs to consider which gestures and interactions are counter intuitive, so some gesture interactions are excluded. In addition, you need to avoid synchronized gestures that can lead to conflict, and everyone's hand habits are so different that the operation of the hand is easily misunderstood. In the selection of gestures, avoid the gesture that may cause conflict, such as single finger right sliding, single finger anti clockwise rotation. In the interaction design level, the fault tolerance of recognition is improved, and the reasonable trigger mechanism is designed.

Click is the most familiar operation in our daily life, whether it is button switch or click screen, mouse operation or finger click operation. Therefore, I will copy the click to virtual space, click operation, the main interaction system of players, so that users can use the most familiar operation to complete instructions. When users open the application, they first contact the video selection page, simple operation can improve the good impression of the product. When you say goodbye to your friends, what do you do with your hand? The gesture of farewell is one of the gestures we often see in our life. It means to say no, goodbye, deny and so on. In VR, I give the gesture the meaning of "return" by returning to the previous level menu and exiting the page of this level. I just need to wave to complete the gesture.

3.7 Release of Finished Products

After the model is created and mapped, it needs to be set in Web format or independent executable file. With the help of the Internet, users can break the limitation of time and space to watch the packaging design. Packaging designers in Virtools more in-depth web page data exchange, or Flash network technology to enhance the fun of packaging, expand the corresponding function.

4. Experimental Test and Result Analysis

4.1 Control Accuracy Test

The control algorithm and control system are verified through the feasibility and effectiveness test of the platform point motion and linear motion by VR. The control accuracy and response time are the two main indicators. The position of the encoder is obtained in real time by PC endpoint dynamic test, and the graph after data collection is drawn by Origin Software in longitudinal mode.

It can be seen from Figure 1 that in the fast continuous motion test mode, under the command of the test action code, the upper platform quickly moves vertically from the origin to the z = 100 mm position, and then resets and reciprocates. As shown in Figure 1, the upper platform has good motion accuracy, and each reciprocating motion can reach the specified position. Observe the longitudinal motion speed curve, the interval must be long continuous motion test mode, under the guidance of platform test operation code and longitudinal motion, quickly from the origin to Z = 100 mm position. After a period of time after the reset of the station, the motion command is sent again in the process of non-zero to reciprocate. The platform motion accuracy shown in the figure is good, and each reciprocating motion can be in place. The experimental results show that the longitudinal motion displacement has high accuracy and can move to the specified position after each instruction. The system has good synchronization and no obvious hysteresis, which meets the requirements of VR platform for fidelity.

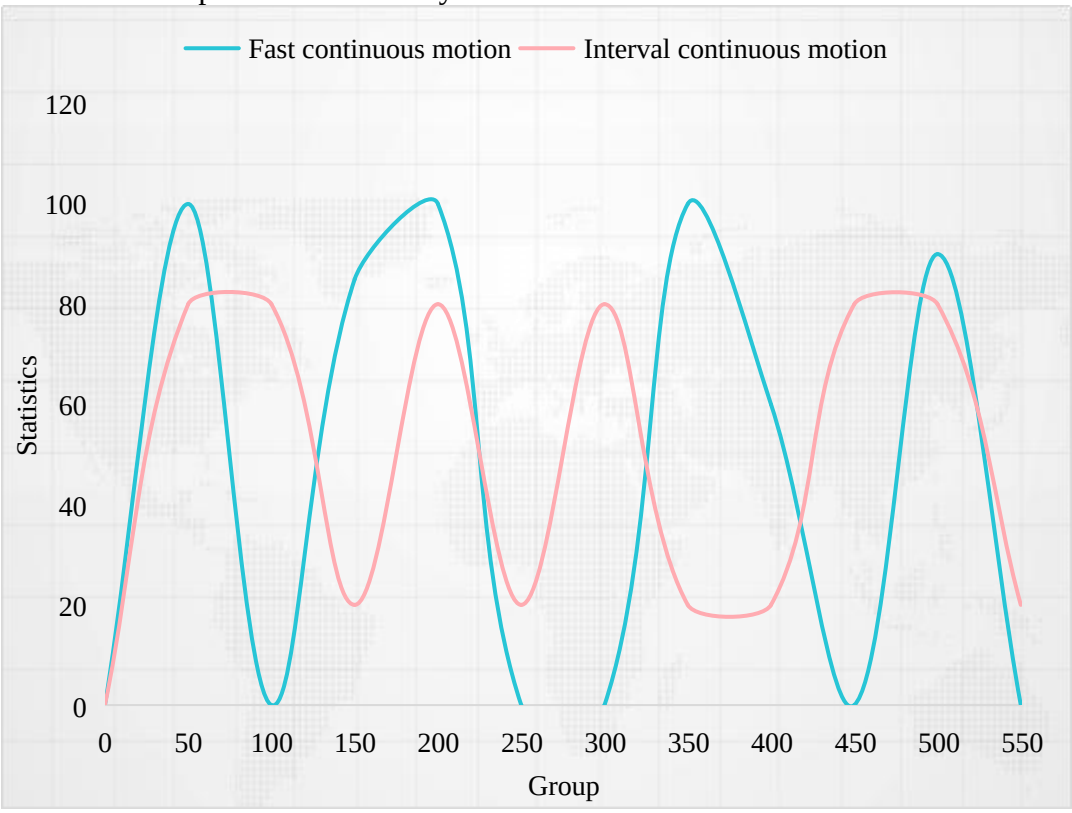

Figure 1: analysis of continuous and intermittent exercise test results

4.2 Response Time Test

In the inching test mode, the platform is moved longitudinally to Z = 10 mm under the finger ring of test motion code, and the longitudinal motion displacement data is observed after ran. In order to ensure the normal use of the platform, the selected motion distance is equal to the displacement within a movement interval. Due to the large amount of data, the actual absolute value is very small. To ensure clear display, the original software is used to draw the graph after data collection, as shown in Figure 2.

As can be seen from Figure 2, in inching mode, the platform response time is less than 3 ms, which is less than the human body's perceptible motion lag time, and the movement process changes smoothly, which meets the immersion requirements of VR platform.

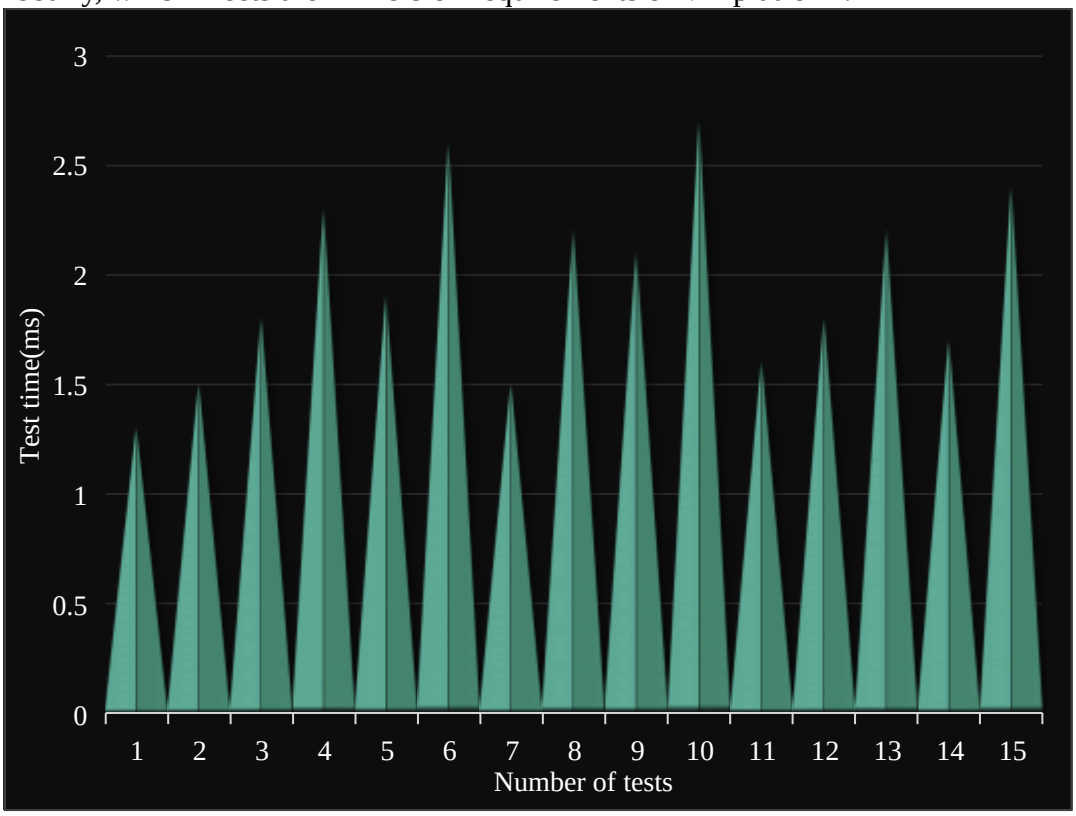

Figure 2: analysis chart of response time test results

4.3 Stress, Content Testing and Analysis

In this test, bump map, reflection map and so on are added to the real system, so the reflection value and bump map options are added to the new test project. Therefore, in the second stress test, community service, mail and rank service are mainly deployed on the same server.

Comparing the two test results in Figure 3, it can be seen that the calculation of bump map and reflection map will increase the workload of CPU, memory and other hardware devices of the system, which is also the normal state of the system during model simulation. Therefore, in the system production process, by comparing the data sorting, the CPU utilization is close to the peak, so this situation is still acceptable. Through two pressure tests of the system, the number of normal planes of the system is 500000 by integrating the number of model surfaces and the level of model fineness.

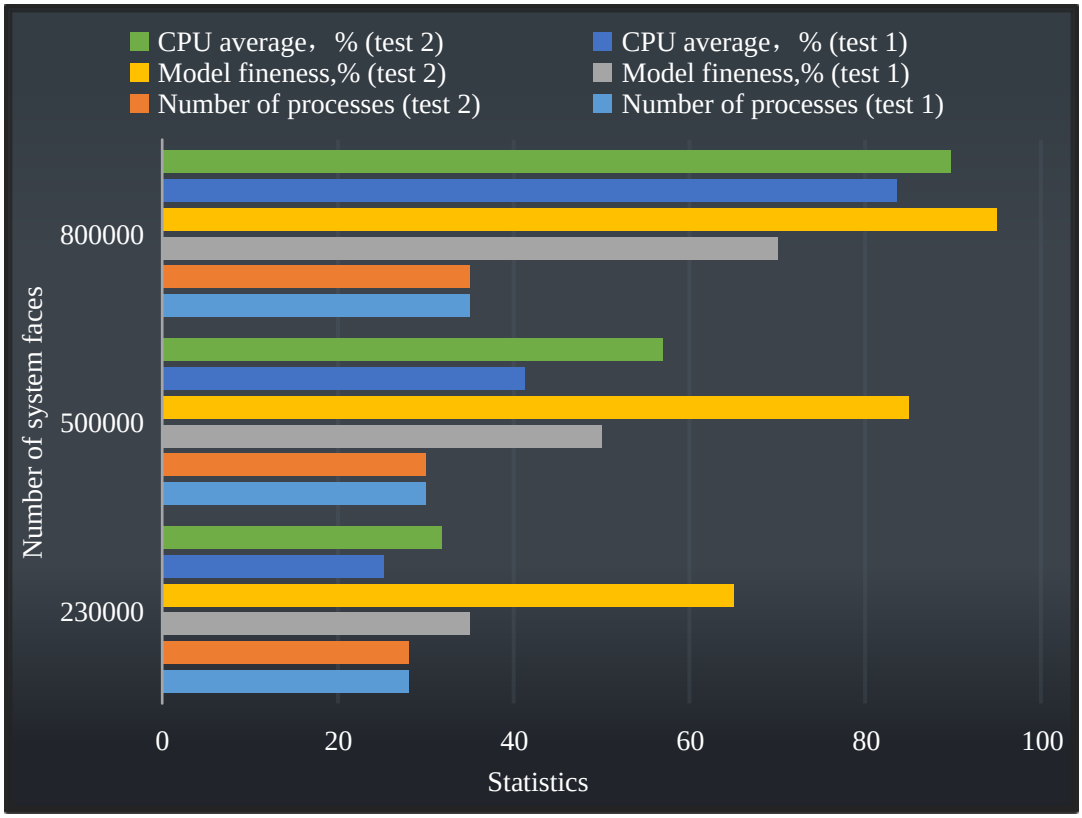

Figure 3: analysis chart of pressure and content test results in simulation state

4.4 Runtime Performance

Runtime performance, including runtime frame rate and runtime mono heap memory. As can be seen from Figure 4, the abscissa is the nth second of the monitored VR application running, and the ordinate is the frame rate. Although the frame rate fluctuates per second, its average value is 88.63 frames per second. In VR applications, in order to get a good experience, the frame rate should be from 90 frames per second to 120 frames per second. Therefore, the monitored VR applications are lagging behind, but they still provide a good experience. To monitor the abscissa mono and the runtime heap memory, the virtual reality application runs for N seconds, and the ordinate is mono heap memory. The data shows that the total mono heap memory and mono heap memory use the total mono heap memory by an average of 50.8 MB. The average memory usage of mono heap is 16.12 MB, and the total heap memory of mono curve is very smooth. There is no increase in mono heap memory usage, so there is no mono heap memory leak problem.

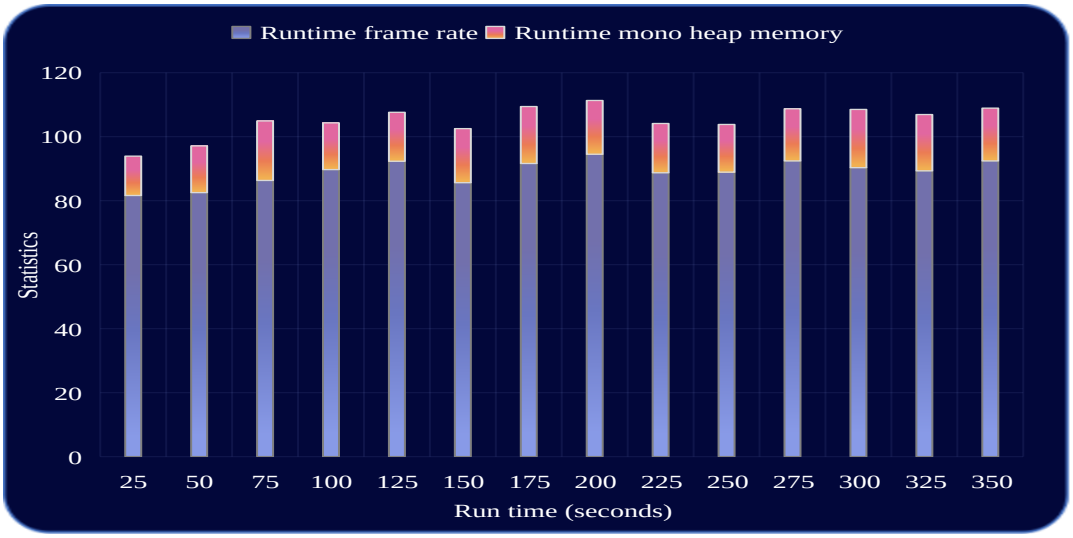

Figure 4: runtime performance analysis chart for continuous time

5. Conclusions

In recent years, VR technology has gradually developed from the game field to the major commercial fields, becoming an important part of industrial upgrading, and has made outstanding contributions to economic development. The success and development of VR technology benefits from a variety of traditional and high-tech. It can be said that VR technology is a combination of various technologies, and the visual communication technology, which plays an important part, has been fully developed. Under the support of visual communication technology, VR technology and industrial design have been well combined, and the key is the packaging visual communication technology. The research of this paper is based on the combination of VR technology and packaging visual communication technology, which can further strengthen the cooperation between the two and optimize the cooperation mode. In order to achieve this goal, this paper reestablishes the VR system, the core of the system is mainly around the packaging communication technology. Through the optimization design, the system achieves good packaging design ability and good user experience. In order to verify the real performance of this system, at the end of the paper, we do a lot of related research, including pressure, content load, operation performance and so on. The experimental data show that the overall performance of the system is good. It improves the user's immersive experience and optimizes the stability of the system. Compared with the traditional VR system, the system has obvious advantages.

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