Application of virtual reality technology in industrial design

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Abstract. In expounds the principle and method on the basis of industrial design, emphatically discusses the basic concept of virtual reality, virtual product design modeling method and process, and points out that the application of virtual reality technology in industrial design greatly sped up the cycle of product design.

1. Industrial design
Industrial design is the combination of technology, art and economy after industrial revolution [1]. In the 1930 s, to seek the practicability of industrial products and the integration of aesthetic, gradually formed a industrial product development and design as the main object of multidisciplinary knowledge integration, integration, new design disciplines. With the process of modernization, science and technology is developing rapidly, people's needs are diversified, and the traditional design concept of upper industry has not adapted to the needs of modern design. Especially the rapid development of computer technology, computer graphics, computer aided design application of thorough and the development of virtual reality technology, computer aided industrial design has become an important means of modern industrial design. Computer aided industrial design is not only the doctor shorten product design cycle, and greatly improve the design quality, and the application of virtual reality technology in industrial design, guarantee the one-time success rate of product development, accelerate the process of the product development, make the designers, users can fuse design products that meet the needs of the market, at the same time greatly enriched the theory and method of modern industrial design.

International association of industrial design (ICSID) in 1980 to the industrial design is defined as: in terms of mass production of industrial products, with their training, technology [2], knowledge, experience and visual perception and give material, structure, construction, shape, color, surface finishing and decoration with new quality and specifications of the design activity, is called the industrial design. The industrial design of the information age not only includes the traditional industrial product appearance design and engineering design, including market research, consumer investigation, human-computer engineering research, public relations planning, corporate website design and maintenance, and service in the whole process of product production and sales work.

Industrial design is a beautiful form cloak for science and technology and machine production of magic, the primary purpose of design is to science and technology into ordinary people can understand and participate in things [3], in the service of the production and living of human beings. Industrial design major premise is to industry, all design activities are built on the basis of industrial production, each historical period design presents the features and the application of the technology were especially manufacturing level of industrial technology level, reflect, science and technology progress on the one hand, will change the technical means of industrial design, change the design procedures and methods; On the other hand, it will open up new areas for industrial design. The evolution of manufacturing mode
is often accompanied by change in the industrial design philosophy, a blend between the two in the course of social development, mutual influence, in two hundred below for manufacturing model to the analysis of the evolution can be seen clearly in this.

At present, the domestic product design and manufacturing have been using computer aided design and rapid prototyping technology to make the grass [4], but is still the traditional product design process: sketching, rendering - structure - model. While the three process has been through a Shared database and networking to realize interaction, drawing phase changes can be completed quickly, but still need to make physical model and the prototype to study design is beautiful and practical. Whether man machine is reasonable and so on. Because designers, manufacturers and consumers could not timely communication, modify the model stage is often several times, this trouble so expensive work be restricted designer free play and shorten the design cycle of the bottleneck, and extended the product development cycle. Therefore, new technologies need to be introduced to break through this bottleneck.

2. Virtual reality technology.

Virtual banquet technology is now the end of the 20th century the rise of a new integrated information technology, it combines computer graphics, multimedia technology, artificial intelligence, human-computer interface technology, digital image processing, network technology, sensor technology and highly parallel real-time computing technology, information technology[5]. Virtual Reality technology ViMuM Reality (VR for short) is a highly realistic simulation of people in the natural environment dynamic behavior such as audio-visual man-machine interface technology, simple is a kind of can create and experience the virtual world of computer system. Now it has been widely used in various aspects of social life, such as "virtual production", "virtual trade", "virtual market", "virtual network" and so on. The emergence of the computer world has changed some of the concepts in the computer world: the concept of "computer as the main body" is the idea that "people are the main body of information environment". At the 1993 world electronic academic year published by American scientists bur 'virtual reality system and its applications), proposed a "triangle" of virtual reality technology, it simply means the basic characteristics of the virtual reality technology, namely: the three "I" (Immersion immersive, Interaction, interactive operation, Imagination thinking idea), including the feelings of people in the whole system is one of the most important, emphasize the people in the virtual reality system leading role H J. Computer generated 3 d virtual environment to enable participants to make people experience in this environment, and through the special equipment (stereo display system, helmet display, tracking localizer, 3 d MOUSE, data and force feedback data glove) realize the natural human physical interaction in virtual environment investigation and operation. And this experience is the purpose of the industrial establishment model.

In the early 1980s, American scientist rael proposed the concept of "virtual reality" to pursue the perfect and rational design of products. The western countries have applied virtual reality technology to all aspects of manufacturing, and their product design has implemented the sketch -- the effect diagram -- the structure diagram -- the whole process of the model interaction and reversibility. VII and holographic technology can be used to establish the virtual model is used to design research: It can be used as a virtual product for customers to try out, greatly shorten the time of product development and reduce the risk of new products. Robert robb, a design manager at ford motor company's cologne research center, said the use of virtual design technology could reduce the overall design process by two-thirds. In the 21st century, virtual design will play a magical role in architectural design, equipment design, product design and costume design.

At present, virtual reality technology is mainly used in aerospace (aviation) flight simulation, simulated military exercises, etc., and the application in industrial design has not been reported. But there is no doubt that the development of VR technology in the application of industrial design is the development of industrial design tomorrow, because it can realize any steps in the process of design investigation and operation of the interaction, and what you see is what you get, so it will be even more rapid designer, image design, concrete implementation and modification. Reduce unnecessary labor, strengthen the industrial designer and structural engineer resource sharing, increase the communication
among designers and owners and users, improve the speed of product updates, reduce market risk, create better economic benefits.

3. Virtual product design.
"Under the virtual reality human-machine interactive technique has the features: one sharing control interaction[6], virtual reality technology have some knowledge of the computer, realize the man-machine dialogue nature, control machine sharing with people, the user's role is only one data source; Interaction of reality and virtual reality system of interactive media is "repetition" of the real world, simulation, and even imagination and fiction, the user is not feel he is using the computer, but in dealing directly with world objects in the real or unreal; The man-machine interactive way of naturalness, human-computer interaction in virtual reality no longer using the mouse, keyboard, menus, etc, and the use of multimodal human computer interaction way, to "barrier-free" human-computer interaction development continuously. Virtual reality is trying to eliminate the difference between man and machine by enabling users to play an active participant role in a computer-generated virtual world.

3.1. Virtual reality system.
The virtual reality system consists of four key parts: virtual environment, virtual reality software, computer system, input device and output device. Virtual environment is computer generated human-computer interaction environment, has a vivid visual, hearing, touch, such as interactive information, the user can from any Angle, position, continuously to watch and inspection, the virtual reality software provides a virtual environment created, interactive control and real-time rendering, interactive information processing of input and output devices; Input and output devices is the human-computer interaction interface, virtual reality system input device is used to track the user's Head, eyes, hands and body position and direction, usually including three-dimensional tracking device, data gloves, 3 d mouse, such as speech recognition, gesture recognition, body now the input of language equipment and technology has been gradually widely used in virtual reality system, output devices used in the virtual environment of visual, auditory and tactile information back to the user, usually including the helmet Mounted Display (HMD: Head Mounted Display), speech synthesis, stereo sound, sound equipment, tactile system, etc. Computer system is the computing environment of virtual reality system.

3.2. Modeling method of virtual environment.
Virtual environment is the core of virtual reality system, which is the interactive environment of human-computer interaction of virtual reality system. The creation of virtual environment includes two aspects: virtual reality and virtual reality. Live along is to the real world of multidimensional awareness information digital space mapping to the computer to generate the corresponding virtual world, mainly includes the construction of virtual scene model, space tracking, sound localization, visual tracking, the key techniques such as these technologies make realistic virtual environment generation and virtual environment to the feast when user interaction information detection and access is possible; Virtual JingShi through all kinds of high performance computing and simulation technology is a computer generated in the virtual environment scene or object can produce all kinds of vivid sensory stimulation, and feedback to the user in the form of as natural as possible, including realistic visual perception, auditory perception, force and tactile perception, such as the HMD, 3 d glasses, such as large screen projection stereo display technology, 3 d sound technology, the force feedback hand Set, force feedback joystick and so on.

The current modeling methods of virtual environment are generally divided into three categories: geometric modeling (Geometry based VE), image-based rendering (image-based VE) and Hybrid method based on geometric modeling and image rendering (Hybrid VE).

3.2.1. Geometric modeling method.
This method usually USES modeling software (such as 3DS MAX, AuloCAD, etc.) to build the model manually. Or by measuring the surface of 3d objects directly, the discrete 3d data is obtained, and then
the three-dimensional data is triangulated to obtain the polygon description of the scene. Virtual environment is composed of three kinds of 3d geometries. In the virtual environment, roaming is based on real-time calculation and real-time rendering of 3d geometry based on observation points and their observation direction.

3.2.2. **Method based on image rendering.**
This method uses the panorama set to construct the virtual environment, and roaming in the virtual environment is equivalent to choosing different panoramas. The panorama can be generated by computer, or it can be taken with panoramic camera or captured by ordinary camera. This method is simple to make, the scene is realistic, and it can display the built environment in real time.

3.2.3. **Combination of geometric modeling and image drawing.**
This method develops a more optimized virtual environment through the advantages of the above two modeling methods. Hybrid approach, based on the virtual environment, based on image rendering is fast, cheap, convenient, and the advantages of the model, build body scene, on the basis of the fusion of computer rendering 3 d geometry model, realize the interactive interaction.

3.3. **The design process of virtual products.**
Virtual products (Virtual Product, VP) is in the computer simulation and show the whole process of a real Product, which are read from ci design, detailed design, manufacturing, advertising and marketing, such as process, it is the application of virtual reality technology in Product design. Specifically, the whole process of virtual product design includes computer aided concept, computer aided detail, virtual manufacturing, advertising design and virtual market design. The conceptual design of the product includes the design process from the requirements of the product to the detailed design. It includes functional design, principle design, shape design, layout design and preliminary structural design. Computer aided conceptual design involves design methodology, ergonomics, artificial intelligence technology, CAD technology and cognitive and thinking science. After the concept design of the product, the product should be designed in detail. A virtual product is a digital product that has the characteristics that a real product must have.

By simulating the real-time function of the product, the designer or user can use the virtual product as the real product. After finishing the design of the product, the virtual products to be manufactured are formed in the computer. Before the virtual product is put into production, it is necessary to simulate the manufacturing process of the product in the virtual manufacturing system (VMS). In order to adapt to the fierce market competition, the design manufacturers actively bring their own products to market. The virtual reality technology of virtual product animation advertising and sets up the computer network technology, the user can through the network to design the design of the products, and can be directly in the virtual environment of product function, structure, shape, colour and real-time interaction, understanding, at the same time, also can be used to E-mail the products put forward opinions and Suggestions, let the factory to modify and improve the reference opinions on various aspects of design products, to improve the market competition ability.

4. **Application of virtual reality technology in industrial design.**
Because of virtual reality technology is a very active technology research field in recent years, multimedia technology, a higher level of development, it gives the user "more realistic experience, make it play a very important role in industrial design. Due to the fierce competition in the global market, all countries attach great importance to and actively carry out in-depth research, and turn the research results into productive forces in a timely manner, which is the key to the rapid market capture of products.

An example of car styling design. The design of the product all uses the three-dimensional entity model. In the process of design, on the advice of the users in all aspects, and invite car lovers directly on the model together with designers put forward amendments, observation design and modify process, until the most satisfaction. The designed model is communicated to the engineering design department.
for engineering design and then transferred to the processing workshop for manufacturing. Because the product design process is digital, so save the physical model of traditional methods to manufacture (including concept model, the simulation model, appearance model and production model, etc.) when asked and material. Due to design products to repeatedly in computer design, analysis, interference checking, such as mold design process, make the design drawing workload than traditional graphics workload by more than half.

In the product design process, can be in accordance with the requirements of the different, in different virtual environment, experience the feeling of the modified model, such as modelling, colour, decoration style, many optional components, etc. The fans are watching the whole car's rendering and generating a very realistic 3d model, and fully experience the "real" situation of the car that they love in the virtual environment.

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