Design Principles of Virtual Exhibits in Museums based on Virtual Reality Technology

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ABSTRACT

This paper describes the types of Virtual reality systems, including its categories. These systems are compared and analyzed their merits and flaws. This study also examines the design principles of virtual exhibits in museums.

KEYWORDS

Design principles, Virtual reality technology, virtual exhibits.

INTRODUCTION

Virtual reality is a computer technology that a person can use virtual reality equipment to experience a virtual world or imaginary environment and interact with virtual functions. It is characterized by immersion, interaction and imagination. In this paper, Virtual reality is applied to virtual exhibits in museums. The aim is to compare different types of Virtual reality systems with design principles.

CATEGORIES OF VIRTUAL REALITY SYSTEM

Virtual reality system can be divided into four categories: Desktop-based Virtual reality, Immersive Virtual reality, Augmented reality and Distributed Virtual reality.

Desktop-based Virtual reality

Desktop-based Virtual reality is a set of equipment which is based on computer or graphics workstations. It uses computer graphics, simulation, multimedia and other technical means to simulate the scene (Figure 1). Users can use the computer display, 3D glasses, data gloves, positioning trackers and other interactive devices to communicate with virtual world. Besides, due to low requirements of hardware, reasonable cost and easy popularization, it is widely used in Architecture, Desktop Games, Computer Aided Design and Computer Aided Manufacturing. However, it is easy to be influenced by environment when users experience it. Desktop Virtual reality is also lack of a full sense of immersion.

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Immersive Virtual reality

Immersive virtual reality is that a person uses a helmet or a projection display, through data gloves, positioning trackers and other equipment, to mobilize all senses in virtual space (Figure 2). Users can not only interact with virtual world, but also more clearly and rapidly achieve information with a VR headset. Immersive virtual reality is one of the most immersive VR systems.

Augmented reality

Augmented Virtual reality is called Augmented Reality, often abbreviated to AR. It is a form of Virtual reality (Figure 3). Using the virtual reality technology, it can combine a real-world environment with a virtual one. With the help of AR, users can see videos, texts, virtual three-dimensional models, pictures and other digital information in real environment. It makes our real world more digital, immersive, imaginative and interactive.

Distributed Virtual reality

Distributed Virtual reality, a kind of Virtual reality, often abbreviated to AR (Figure 4). It is a system which can support multiple people to be in a virtual environment. By Distributed Virtual reality, users who are in different places can interact with each other and share their information at the same time. Owing to its special characters, it is used in distance education, engineering technology, architecture, art and other fields.
COMPARISON IN VIRTUAL REALITY SYSTEMS

On the supporting carrier

The equipment of Desktop Virtual reality (Figure 5) is more complex, and it needs to be fixed in a place. The same as Desktop Virtual reality, due to supporting many users, Distributed Virtual reality (Figure 9) can’t move freely and need to be fixed. Different from first two, a kind of Immersive Virtual reality (Figure 7) which is a wireless device can move in any place. But there are two kinds of devices, another is a headset that users only can move in a fixed area. Compared with the first two, these two Immersive Virtual reality’s devices are more flexible. Lastly, Augmented reality, a wireless device, which users can move freely even outside, is different from the other three.

On the user interaction

Both Desktop Virtual reality and Immersive Virtual reality only can make users experience by themselves. Among the users, they can’t interact with each other when they try to enjoy the virtual world. However, Augmented reality and Distributed Virtual reality are different from them, which can enable multiple users to share the same virtual space. At the same time, users can also interact with each other on these two platforms to realize the participation in sharing information.

On the feature of systems

Desktop Virtual reality has the advantages of low cost, small amount calculation, wide application and strong adaptation. However, it is highly lack of immersive which can make users involve themselves deeply in a virtual world and it is easy to be influence by surroundings. For this problem, Immersive Virtual reality can solve it easily. Headsets are design to let users immerse in their virtual world by seeing, hearing, touching and so on. These two systems only can show the virtual
environment, can’t make an interaction with a real world and a virtual world. In that case, Augmented reality takes some advantages in real and virtual environment. Users can see some virtual information in physical world. Also, they communicate with each other at the same time. The same as Augmented reality, Distributed Virtual reality also can share information together although you aren’t in the same place.

**DESIGN PRINCIPLES OF VIRTUAL EXHIBITS**

Owing to different types of systems have different kinds of design principles in display, especially in museum’s virtual exhibits.

**Design principles of Desktop Virtual reality systems**

Designers consider some factors in how to show the exhibits realistically by Desktop Virtual reality systems. First, how to make users be immersed in virtual environment is highly important for designers. With the help of voice, sight and touch, users can be enriched their experience in visiting the virtual exhibition. Second, because of its easy-influence, designing in a fixed area which is enough quiet and dark to put the equipment in a special place is quite essential. Some museums make room for it, a mini dark ‘dark house’. Visitors, in dark and quiet environment, can immerse a virtual museum which has virtual exhibits. Third, the objects of exhibiting have their own history, it is important to enhance designers’ professional knowledge and make sure everything is true. Taking a mistake in wrong years and wrong exhibits, programmers always do it. These three principles will help designers and programmers make Desktop Virtual reality systems serve visitors well.

**Design principles of Immersive Virtual reality systems**

Different from Desktop Virtual reality systems, Immersive Virtual reality systems are more immersive and interactive. However, designers also develop its advantages in using. There are also some principles about how to develop the most immersive systems. First, the environment in this system is able to be pretty realistic and high-reduction. That could make visitors experience an amazing exhibition, even let them be in the historic scenes which shows the exhibits the year they in. Second, one of the characters of Immersive Virtual reality is interactive. Programmers pay more attention on how to improve the interaction between visitors and exhibits. It easily helps visitors to know exhibits well. Third, due to its limit, Immersive Virtual reality system is not convenient to move anywhere. Programmers are focus on how it can make visitors feel that they are in this scene and not just in a fixed place. If programmers design a virtual world with these principles, the systems will build a realistic- virtual exhibition for us.

**Design principles of Augmented reality systems**

Desktop Virtual reality systems and Immersive Virtual reality systems are all in a virtual world, but Augmented reality is focus on real and virtual environment. For this point, first, how to deal with these two things is a key to design a wonderful
exhibition. Programmers need to use this system to enrich exhibits’ words and pictures for visitors. Second, visitors can use it to move in any place so that designers can reappear the scene of history, visitors can know more information by picture and voice. Third, in museums, there are too many exhibits, but they can’t face to visitors at the same. Augmented reality can show all things in a real world by virtual means which increase exhibits usage. Therefore, designers reasonably create a special system, making a more interactive and more imaginative exhibition.

Design principles of Distributed Virtual reality systems

Different from other systems, Distributed Virtual reality system is for multiple users. Its special characteristic makes some special design principles. First, programmers need to provide a wonderful platform that can hold many users at the same time. Expert it, designers pay more attention on its graphic design. In museums, it is used to hold a virtual exhibition for distance learning. Second, in distance learning, it is better to make sure each user not be influenced by others. Designers try to show every exhibit in a clear order. Third, the system which users can’t move freely is concerned about its virtual world, not real environment. So that each user can experience a good virtual exhibition distance learning.

SUMMARY

People can experience a virtual world or enjoy a virtual-real environment by Virtual reality which is a kind of computer technology. It is divided into four kinds of systems. Each of them has their specialties. Due to these advantages, Virtual reality is applied to virtual exhibits in museums. Different kinds of Virtual reality systems have different design principles. Desktop Virtual reality is widely used in a low-cost virtual exhibition, which also can show all exhibits. Immersive virtual reality is popular in a historic scene which can make visitors easily know the history of this exhibit. Augmented reality is a good helper, can provide each exhibit with their commentary which introduce the exhibit’s history or basic information in a virtual mean. Distributed Virtual reality is most used in a big interactive scene, such as a virtual war simulation and gaming system. According to these characteristics, designers should follow some principles on these virtual reality systems, to optimize the form of display and show the best exhibition for visitors in a museum.

ACKNOWLEDGEMENTS

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