Upgrading Tourism Experience of Tourists by Using AR Technology

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Abstract. Augmented reality (Augmented Reality, referred to as AR), is a technology that calculates the position and angle of the camera image in real time and adds the corresponding image. The goal of this technology is to set the virtual world in the real world and interact with each other on the screen. This technology was first proposed in 1990. With the improvement of the computing power of portable electronic products, augmented reality is more and more widely used. This paper will share and study the AR technology to enhance the tourist experience, and strive to do relevant technical support and reserve for upgrading the tourist experience.

Keywords: Augmented reality (AR) · Tourist experience · Image technology

1 Introduction

This is a new technology - enhances reality (AR), which can seamlessly integrate real-world information and virtual world information, and establish a related connection. It applies virtual information to the real world, through our well-known computers and other science and technology [1].

The reality is superimposed with virtual simulations so that virtual information can be perceived by human senses of real world. In order to transcend the realistic experience. In 2018, the number of investments in China's VR/AR industry was 109, and the investment amount was 10.977 billion yuan. From 2015 to 2016, China's VR industry “exploded”, and the VR market once “let a hundred flowers blossom”. In 2016, the number of VR/AR industry investment reached 299, which is the highest in history. However, from 2017 to 2018, the capital market gradually returned to rationality, and both the number and amount of investment in the industry declined. From the end of 2018 to 2019, with the approach of the 5G era, China's VR/AR industry capital market showed signs of recovery. From January to September 2019, the number of financing in China's VR/AR industry was 49, with the financing amount reaching 9.921 billion yuan [2–5].

According to online data and predictions by relevant agencies such as tourism agencies, the number of world tourists will grow at an annual rate of 3.8% from 2020,

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and it is estimated that by 2030, the number of world tourists will reach a staggering 1.8 billion. In addition, according to the data obtained by the World Tourism Association, In 2010, the number of global tourists and tourism revenue will grow at an annual rate of 4.3%, higher than the annual growth of world wealth (3%) in the same year. By 2020, the income of the tourism manufacturing will reach 16 trillion US dollars, countertype to 10% of the world's GDP; 300 million jobs will be provided, explaining for 9.2% of the world's total profession, further confirming the important position of the tourism manufacturing in the global thrift. However, there are few researches on AR technology in China [6].

In recent years, the use of AR technology in the tourism industry is also numerous, such as tourist path navigation, enhanced appreciation of AR scenic spots and other features, this paper will systematically analyze the related technologies [7].

2 Basic Principles of Augmented Reality

2.1 Augmented Reality

Early mobile augmented reality systems were based on the idea of adding images, sound, and other sensory enhancements to a real-world environment. For example, television networks use images to send messages around the world. Right? But all TV networks do is show still images, which cannot be adjusted as the camera moves, which is also one of its partial points. The augmented reality that this article is talking about is far more advanced than anything you see on TV, unlike traditional technologies like television. Because these systems can only display images that can be seen from one Angle. What VR is going to do is make the next generation of augmented reality systems capable of displaying images that everyone in the audience can see [8].

In all kinds of universities and high-tech corporations, augmented reality is still in the premier stage of research and development. Eventually, perhaps by the end of the decade, we will see the first augmented reality setups that have been put on the market in large quantities. One researcher called it “the Walkman of the 21st century”. What augmented reality strives to achieve is not only to enhance images to the real environment in real time, but also to change these images to adapt to the rotation of the user's head and eyes, so that the image is always within the user's point of view [9].

2.2 Principle of AR Model

Assuming that u(n), x(n)is a stationary random signal, u(n) is white noise and the differentiation is Ó2, it is hoped that the correlation between the parameters of the AR model and the autocorrelation ak function of the x(n) can be established.

$$x(n) = -\sum_{k=\mathrm{c}}^{D} \mathrm{c}_k x(n-k) + u(n) \tag{1}$$

$$H(z) = \frac{1}{A(z)} = \frac{1}{1 + \sum_{k=1}^{b} \mathrm{c}_k z^{-k}} \tag{2}$$

$$P_x\left(e^{/\mathrm{c}}\right) = \frac{\sigma^2}{\left| 11 + \sum_{k=\mathrm{c}}^{y} \mathrm{c}_k e^{-/\omega k} \right|^2} \tag{3}$$

Multiply both sides of the above Eq. (1) by x(n + m) at the same time, and find the mean, there are:

$$r_{1z}(m) = E\{x(n) * x(n+m)\} = E\left\{ \left[-\sum_{k=1}^{0} \mathrm{c}_k x(n+m-k) + u(n+m) \right] x(n) \right\} \tag{4}$$

So there are:

$$r_x(m) = -\sum_{k=\alpha}^{0} \mathrm{c}_k E\{x(n+m-k)x(n)\} + E\{x(n+m)x(n)\} \tag{5}$$

So there are:

$$r_{1z}(m) = -\sum_{k=1}^{n} \mathrm{c}_k r_{1z}(m-k) + r'_{1=\mathrm{c}}(m) \tag{6}$$

There are:

$$r_{1z}(m) = E\{u(n+m)x(n)\} = E\left\{ u(n+m) \sum_{k=0}^{\infty} h(k)u(n-k) \right\} \tag{7}$$

$$r_{1z}(m) = \begin{cases} -\sum_{k=\mathrm{c}}^{0} \mathrm{c}_k r_{1x}(m-k) (\mathrm{if} : m \geq 1) \\ -\sum_{k=\mathrm{c}}^{0} \mathrm{c}_k r_{1x}(k) + \sigma^2 (\mathrm{if} : m = 0) \end{cases} \tag{8}$$

In the above derivation, the even symmetry of the autocorrelation function is applied, that is, so $r'_{1z}(m) = r_{1z}(-m)$, The above can be written as a matrix as follows:

$$\begin{bmatrix} r_{1x1}(0) & r_{1x}(1) & r_{1x}(2) & \cdots & r_{1x}(p) \\ r_{1x}(1) & r_{1x}(0) & r_{1x}(1) & \cdots & r_{1x}(p-1) \\ r_{1x}(2) & r_{1x}(1) & r_{1x}(0) & \cdots & r_{1x}(p-2) \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ r_{1x}(p) & r_{1x}(p \cdot 1) & r_{1x}(p-2) & \cdots & r_{1x}(0) \end{bmatrix} \begin{bmatrix} 1 \\ a_1 \\ a_2 \\ \vdots \\ a_p \end{bmatrix} = \begin{bmatrix} \sigma^2 \\ 0 \\ 0 \\ \vdots \\ 0 \end{bmatrix} \tag{9}$$

3 AR Composition of Augmented Reality Technology

A set of closely connected real-time work hardware components and some related software systems constitute an enhanced reality system, which typically includes the following three forms [10].

3.1 Monitor-Based

In the AR implementation displayed by the computer display, first, by the captured actual image and enter the virtual scene generated by the computer, then generate the virtual scene generated in the computer graphics system database, finally output to the screen, display it to the screen.

The fulfillment of the monitor based augmented reality institution is shown in the following figure (Fig. 1).

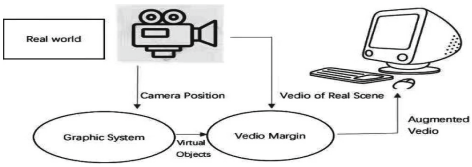

Fig. 1. Monitor-based schematic diagram

3.2 Optical Perspective

The method of displaying the wearable helmet is widely used in a virtual reality system, and the purpose is to enhance the user's visual imitation. According to the specific implementation principles, it has two forms: one is based on optical principles to penetrate HMD. The completion scheme of optical clairvoyant augmented reality system is shown in the following figure.

Simply, high-resolution and non-visual deviations are three advantages, high positioning accuracy, difficult delay matching, relatively narrow vision and high prices, etc., are the disadvantages of it (Fig. 2).

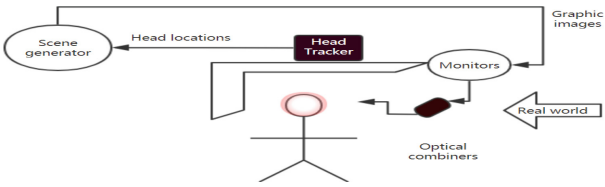

Fig. 2. Optical perspective schematic diagram

3.3 Video Perspective

Video perspective augmented reality system adopts penetrating HMD (Video See-through HMD) based on video synthesis technology, and the implementation scheme is shown in the figure (Fig. 3).

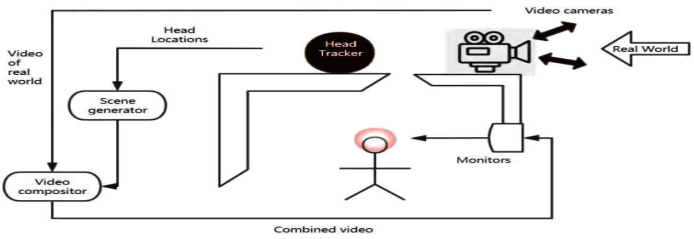

Fig. 3. Video perspective schematic diagram

4 Conclusion

The content of VR tourism will continue to increase with the pace of the times, which will also lead to continuous decline in investment and output equipment prices. Video display quality will gradually improve, and the practical application of software will become more powerful and easy to use. The application of AR technology will bring revolutionary changes to many fields. As an industry that uses this technology, tourism will inevitably have more possible development than other industries.

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