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A Study on 360° Image Production Method for VR Image Contents

Dawei Guo*, Jeanhun Chung**
Dept. of Multimedia, Graduate School of Digital Image &Contents, Dongguk University, Doctor's Course*
Dept. of Multimedia, Graduate School of Digital Image &Contents, Dongguk University, Professor**

VR 영상 콘텐츠 제작에 유용한 360도 이미지 제작 방법에 관한 연구

곽대위*, 정진헌**
동국대학교 영상대학원 멀티미디어학과 박사과정*, 동국대학교 영상대학원 멀티미디어학과 교수**

Abstract 360°panoramic image can give people an unprecedented visual experience, and there are many different ways to make a 360°panoramic image. In this paper, we will introduce two easy and effective methods from those many ways. The first one is through 48 photos to make a 360°panoramic image, the second way is through 6 photos to make a 360°panoramic image. We will compare those methods and tell the audience which one suits themselves. Through those easy design methods introduced above, we can see VR works design became easy and popular, normal people can also make 360°panoramic image, and it promotes the industry of VR image contents.

Key Words : 360°Panoramic Image, Image Matching, Image Splicing, VR, 360 degree Fish Eye Lens

요 약 360도 이미지는 대중에게 이전에 경험하지 못했던 특별한 시각적 경험을 제공한다. 360도 이미지를 제작할 수 있는 방법은 여러 가지가 있지만, 본 논문에서는 기존의 제작방식을 포함하여 간단하며 유효한 두 가지의 제작방법을 제시하고자 한다. 첫 번째 방법으로는 48장의 이미지를 합성하여 한 장의 360도 이미지를 만드는 것이고, 두 번째 방법으로는 6장의 이미지를 사용하여 한 장의 360도 이미지를 제작하는 것이다. 앞서 제시한 두 가지 제작 방식의 특징과 장단점의 비교를 통하여 더욱 간단하면서도 효율적인 제작방식을 선택할 수 있다. 소개를 통하여 제시되는 제작방법은 VR작품 제작의 문턱을 낮출 수 있으며, 일반인들도 360이미지 제작을 더욱 간편하게 할 수 있게 됨으로써 VR영상 콘텐츠 산업이 더욱 발전될 수 있을 것으로 기대한다.

주제어 : 360도 그림, 도상 맞추기, 도상 결합, 가상현실, 360도 어안 렌즈

1. Research Background

360°panoramic image is one of solutions to achieve virtual reality. 360°panoramic image can give people unprecedented visual experience which can make people feel actually being anywhere when they were at home[1][Fig. 1]. 360°panoramic image file often has small data size, and it also has lower requirement about

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Corresponding Author: Jeanhun Chung(Dongguk University)
Email: evengates@gmail.com

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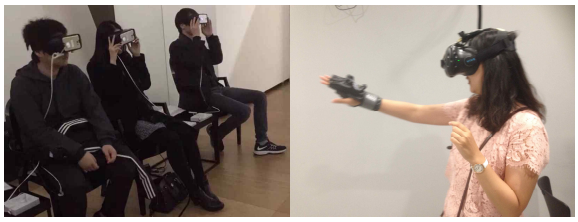
the watching system. It means any terminal equipments even smart phones with applications can watch the 360°image. Normal image and 360°panoramic image both can show and record, but normal image has limited visual angle and no sense of space, 360°panoramic image not only has 360°visual angle but also has sense of space that can let audience immerse in their virtual space. When we need to rebuild a real, visual and all-sided scene for show or record, using 360°panoramic image is the best selection. And recently, use 360° panorama image into artworks also become to a modern trend[2]. Because of 360° panorama image's strange visual experience, many art works even modernism style art works choose this way as the design method[3]. So, studying or researching how to make 360°panoramic image is necessary[4].



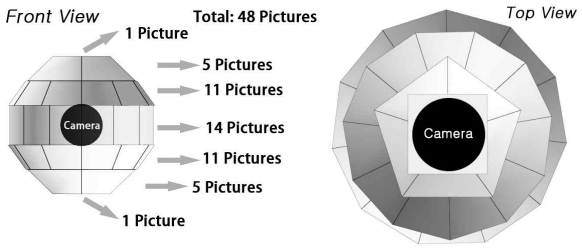
[Fig. 1] Audiences Watching the 360°Images

There are many ways can make 360°panoramic image and using sphere camera to shot 3D modeling is a common one of those methods[5]. But in the real world, geometry objects are very complex, many objects' modeling needs to be manufactured by professionals. So, in that way, production requires staff with high level modeling ability or personal study of 3D tool, which increases labor cost and time cost[6]. It is not a good way for normal people, so using sphere camera to shoot 3D modeling will not be discussed in this paper. We will talk about some methods which are easy and cheap for normal people or fresh designers.

Compared with 3D modeling, now there are some efficient or easy production methods. This paper will lay emphasis on two of them, and will compare their characteristics and application range.

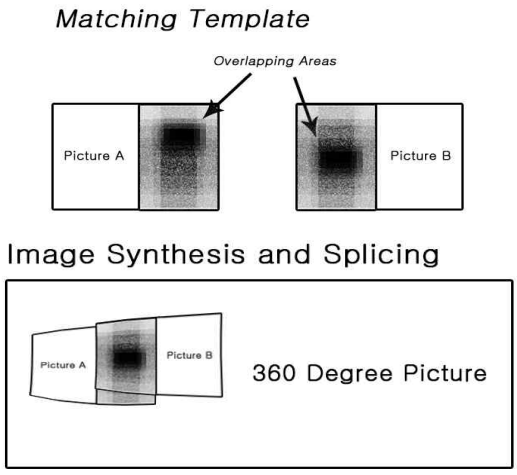
2. Method Introduction

2.1 The First Method: Use 48 photos to merge a 360°image



[Fig. 2] Camera's Position

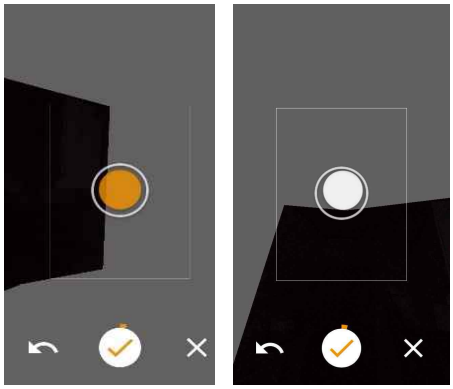
Using 48 photos to merge one 360°image method uses 360°panoramic mosaic technology[7]. Actually in image splicing process, there is no limited photo numbers, it can use more than 48 photos to merge one, for example the largest panoramic image in the world is made by 48640 photos[8]. But here we use 48 photos[Fig. 2], which is because comparing with using more photos, 48 photos nearly contain all scene information yet with less photos[9]. So, using 48 photos to make a 360°image is enough.



[Fig. 3] Panoramic Mosaic Technique

360°panoramic mosaic technique[Fig. 3] is based on image features matching. Matching process's first step is to extract all images' local feature points[10]. Feature point in one image means the point which contains a large amount of information, and through those points the whole image can be constituted. In computer graphics science, classic algorithm for feature point selection contains SIFI algorithm, FAST algorithm, SURF algorithm[11]. After getting most feature points and formed feature vectors, the next step is matching with those points. The basic point matching mode is Nearest Neighbor mode. The next step is image splice, and image splice is based on sphere panoramic mode. That mode uses camera as the center of sphere, then projects image into sphere's internal surface, and finally gets the spliced 360°panoramic image.

This design method has a strong smart phone software support which is Google Street View [Fig. 4]. So, normal people in design process do not need to worry about image matching or image splicing. They can just take photos, and all other steps are automatic. In the application, there are fixed points existing in camera scene. By staying the same position and taking photos follow those fixed points we will get precise 360°image. I use that smart phone app took a 360° image at Bukhan Mountain's top as a example[Fig. 5]. We can see the photo work's quality is ok, and it also means we can use this method to take 360° panorama photo nearly every where.

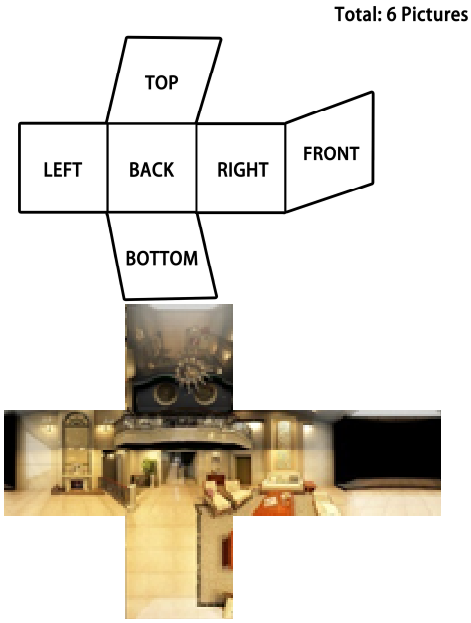


[Fig. 4] Google Street View's Interface

Not only smart phone can splice images, computer tool also can merge images into one 360°image[12]. In photoshop, there exists an function named "PhotoMerge", it can also automatically splice 360°image[13]. Besides photoshop, there are several common panorama splice tools, like PTgui, Auto Pano Giga, PanoramaStudio Pro, etc. So, we can also use DSLR camera to get images. But in this way designer needs tripod to fix camera.

[Fig. 5] Example : Bukhan Mountain Panorama (Used 48 Photos)

2.2 The Second Method: Use 6 photos to merge a 360°image



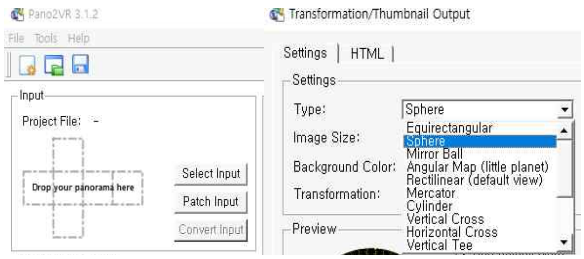
[Fig. 6] Image Position Distribution

There are three kinds of panorama mode: cube

panorama, cylinder panorama, sphere panorama[14]. Using 6 photos to merge a 360°image's method is based on cube panorama mode. Cube panorama mode uses cube's center as a fixed viewpoint to view the scene, and records whole scene into cube's 6 faces[Fig. 6].

[Fig. 7] Panorama Head

Cube panorama is composed of 6 faces images, so when we design cube panoramic image, we need left, right, front, back, top and bottom side′s photos, then cast them into a cube′s 6 faces. So in this method, image capture and camera setting is a hard work. Those works need special apparatus like panorama head[Fig. 7]. Then we need to take photos from each horizontal 90°and vertical 90°angle. Finally we use those 6 photos to merge a cube. In this cube′s center, visual angle can rotate 360°horizontally or vertically, so sometimes it is also called 720°panorama. If we use 6 images to contain all environment message, we'd better choose camera lens of 21mm. But under this focal segment, image deformation is obvious, so this method does not fit for a small background environment.



[Fig. 8] Pano2VR's Interface

Let us make an example by using Canon EOS 6D as the production tool with 24mm lens. First, we fix camera into panorama head. Then we take the front shot, back shot, left shot, right shot and top shot. But when we take the bottom shot we need reversal axial and proofreading position first. The next step is taking those photos into photoshop to clip by 1:1 scale. Splice step can also be finished in photoshop, or through Pano2VR to merge photos automatically. Pano2VR is a computer software to deal with panoramic images[Fig. 8]. In Pano2VR's output mode, panoramic image mode can be exchanged. It can also output horizontal cross view image, sphere view image and equirectangular image.

3. Comparison

3.1 Efficiency and Difficulty

Using 48 photos to merge a 360°image's method looks difficult, but that design method has a huge software support like Google Street View thus it simplifies the production process. Auto splicing and merging let normal people finish the whole production process in 10-15 minutes.

Using 6 photos to merge a 360°image's method looks easy, but that method needs high angle accuracy, no error is allowed in each photo's shot angle. And at the moment, there is no smart phone application can support that design method. The work can only be finished by computer. The whole production process may need 1 hour or more than 1 hour.

From the production cycle perspective, the easiest and the most effective design method is the first one.

3.2 Production Budget

Using 48 photos to merge a 360°image's method just needs a smart phone camera, and does not need any professional requirement. Google Street View is also free. So, everyone can use their smart phone as design

tool to make 360°panoramic photos. Nearly no production budget is needed by using this method.

Using 6 photos to merge a 360°image's method has a high professional requirement, needs to buy some professional tool like panorama head. So, this method requires little production budget.

From the production budget perspective, the cheapest way is using 48 photos to merge a 360°image. Another method needs a designer who can afford them. But for most of people, neither of them is ridiculously expensive.

3.3 Image Accuracy

Using 48 photos to merge a 360°image's method will get a high picture quality panoramic image. But in production process, there exists some angle problems or time difference problems. For example cloud cannot stay at a fixed position between the first photo and the last photo. So moving object may come out many mistakes in the finial panoramic image. Thus this method cannot achieve a high image accuracy.

Using 6 photos to merge a 360°image's method can get a very high accuracy panoramic image. High wide angle scene and strict shooting angle let our work become a perfect artwork. Even though this method is not easy to grasp, the shot scene is limited, and it only use square photos, it is still an excellent method, and many excellent photography works are made by using this method.

So, from the image accuracy perspective, using 6 photos to merge a 360°image's method is the best.

<Table 1> The Comparison of Two Methods

Method	Use 48 Photos	Use 6 Photos
Efficiency	High	Medial
Difficulty	Easy	Difficult
Budget	Cheap	Medial
Image Accuracy	Medial	High

4. Conclusion

Through the comparison, we can see those two methods suit different people.

Using 48 photos to merge a 360°image's method is easy, cheap and requires low professional skills. But the final work's accuracy is not very high. So, this method suits almost all people. It means everyone can recorded their view sight for share to others.

Using 6 photos to merge a 360°image's method is a little hard and needs some professional equipment. But the final work's accuracy is very high. So, this method suits a designer who has some experience and economic budget.

Through introducing and making comparison in this paper, we realize 360°panoramic image design method is not difficult or mysterious as we think before. Not only through 3D modeling, but also through camera or even through smart phone we can make a 360°panoramic image. According to the requirements, we can chose a method which suits different people.

We also realize nowadays VR image contents design becomes easy and popular. Those easy, cheap and effective design methods will change VR design work. Now many people can use their smart phone or camera to make VR contents. Many normal people become designers which can promote the industry of VR image contents. In the future, we cannot think what will happen. VR image works can be used everywhere, such as art, entertainment, education, economic, communication media, and etc[15].

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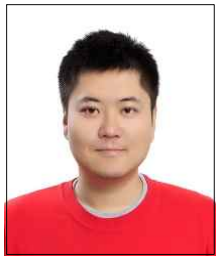
곽 대 위(Guo, DaWei)



・2010년 2월 : 광운대학교 미디어영상학부(문학사)
・2014년 9월 : 동국대학교 영상대학원 멀티미디어학과(MFA)
・2016년 9월 ~ 현재 : 동국대학교 영상대학원 멀티미디어학과 박사과정
・관심분야 : VR, Contents Design, 3D Scan, Computer Animation, Visual Effect 등.
・E-Mail : tlookguo@hotmail.com

정 진 헌(Chung, JeanHun)

・1992년 2월 : 홍익대학교 미술대학 시각디자인학과(BFA)
・1999년 11월 : 미국 Academy of Art University Computer Arts(MFA)
・2001년 3월 ~ 현재 : 동국대학교 영상대학원 멀티미디어학과 교수
・관심분야 : VR, Contents Design, 입체영상, 3D Computer Graphic, Computer Animation, Visual Effect 등.
・E-Mail : evengates@gmail.com