Chroma Keying between Integral Photography Images

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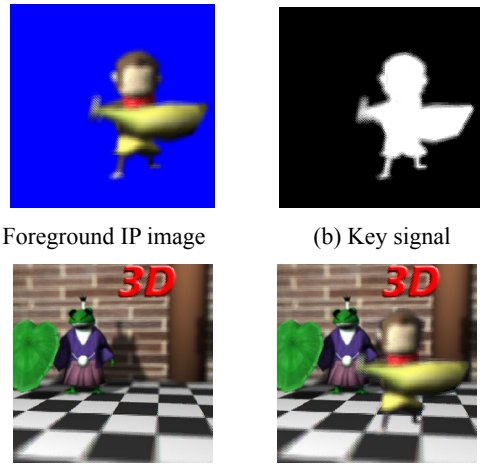
1 Introduction

Chroma keying is a well-known technique for mixing two images in which a specific color of the foreground image is made transparent. When this technology is applied to integral photography (IP) images, each of which is a textured image in which images taken from hundreds of angles are integrated, it is very useful. IP is an ideal 3D display method because parallax in all directions can be obtained without the need for wearing special glasses. Moreover, it needs only simple hardware consisting of an LCD and a fly's eye lens. In particular, in the case of the extended fractional view (EFV) method [1][2], an inexpensive ready-made fly's eye lens can be used. Animation is also possible by displaying frames successively. However, creation of IP images is computationally intensive because multi-viewpoint rendering, in which a large number of images are observed from hundreds of viewpoints, is necessary. Therefore, we developed a chroma keying technology to reduce the processing time. By creating the foreground IP images and the background IP images separately and combining them later, the processing time could be reduced greatly, especially when the background was stationary.

2 Croma keying between IP images

Figure 1 shows an example of a croma keying. First, a foreground (FG) IP image (a) and a background (BG) IP image (b) were synthesized separately by using the existing method [1][2]. Here, the background of the FG IP image must be uniformly colored with a color that is not used in the object. In this case, the color was blue. Second, a key signal (c) was made from the FG IP image by extracting the specific colored area. Third, the Final IP image (d) was made by combining the two IP images based on the key signal.



(a) Foreground IP image (b) Key signal

(c) Background IP image (d) Final IP image

Figure 1 Example of croma keying

3 Experiment

A 12.1-inch laptop PC (Fujitsu FMV-R8250, number of pixels is 1280 H × 800 V, dot pitch = 0.204 mm) and a fly's eye lens (Fresnel Technologies No. 360 but the external size is enlarged, lens pitch = 1 mm) were used in the experiment as shown in Figure 2. The experiment showed that high quality 3D animation with full parallax was possible. The image quality of the IP image synthesized by the chroma keying was almost equal to that of the IP image made by our conventional method without using the chroma keying. And the processing time could be decreased to about one third.

This technology is also applicable to a new interactive 3D display system in which only a foreground object is moved by keyboard operation as shown in Figure 3. To keep the z-coordinate of the moving object constant, the amount of horizontal and vertical motion is restricted to integer multiples of *Lx* and *Ly* respectively as shown in Figure 4. However, errors after the decimal point were caused because the lens pitch was not an integer multiple of the pixel pitch in the EFV method. To avoid the accumulation of this error, the amount of motion was calculated by the real number, and it was rounded off to the nearest integer at the last stage. As a result, smooth motion of the foreground object was achieved.

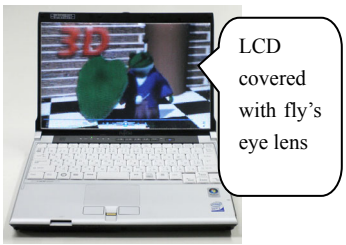


Figure 2 3D display using laptop PC and a fly's eye lens

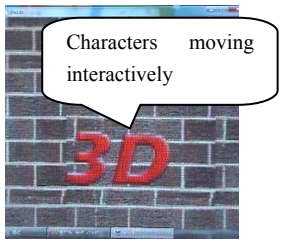


Figure 3 Interactive 3D display

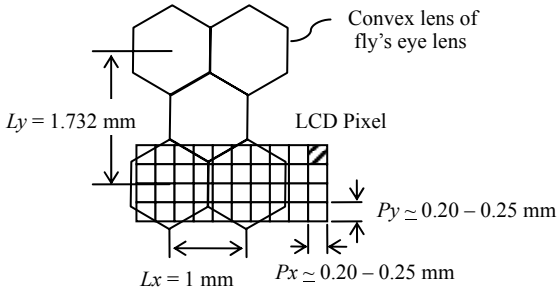


Figure 4 Pixel pitch of LCD and lens pitch of fly's eye lens

4 Conclusion

A new chroma keying technology for IP images was proposed, and it was shown that the technology was useful for reducing the processing time. In addition, it was also shown that it could be applied to a new interactive display. This technology seems to be applicable to games using full-parallax 3D displays.

References

[1] Kazuhisa Yanaka: "Integral photography using hexagonal fly's eye lens and fractional view [6803-58]," Proc. of Electronic Imaging 2008 (included in Proc. of SPIE on CD-ROM, Volumes 6803-6822).
[2] Masahiko Yoda, Akufumi Momose, and Kazuhisa Yanaka: "Moving integral photography using a common digital photo frame and fly's eye lens," SIGGRAPH ASIA 2009 Poster.

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SIGGRAPH 2010, Los Angeles, California, July 25 – 29, 2010.
ISBN 978-1-4503-0210-4/10/0007