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Introducing Experimental Stereoscopic into Networked Live Performance with Very Limited System Resources

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Abstract: Stereoscopic and its wide application are recently getting popular. In this paper, we examine potential limitations that might hinder the direct introduction of stereoscopic into networked live performance. This paper also suggests a plausible example of simple and general configuration that supports stereoscopic networked live performance with very limited system resources. As a result, experiment quality of stereoscopic networked performance was acquired with minimal resources by using the anaglyph method.

Keywords: networked performance; stereoscopic; e-culture.

1. Introduction

Stereoscopic has wide applications and has recently gained popularity in films and TV shows (Wei-Ming et al., 2011). Reflecting the popularity, the number of 3D digital screens has greatly grown from five in 2006 to 1,067 in 2010. Over three-quarters of digital screens and over one third of total screens in the United Kingdom are now equipped with stereoscopic displays (Jones, 2011). The growth is not about only the facilities but also film productions. 24% of film produced in 2010 were released in the stereoscopic format. However, only the proportion of

stereoscopic films to the total movies was just 0.4% in 2008 (Nevill, 2011). These statistical reports indicate the increasing popularity of stereoscopic.

Film industry can be viewed as the leading business in stereoscopic application but several attempts to produce stereoscopic application are also being made in other fields. The semi-finals and final matches of the FIFA World Cup™ 2010 were broadcasted in live 3D (Johnson, 2010) and the Discovery Communications have announced that they would launch stereoscopic television content networks on everyday basis (Gruenwedel, 2010). These examples imply the high applicability of stereoscopic content.

Although stereoscopic content is becoming popular and prevalent, introduction of stereoscopic in stage performances as a type of cultural content has yet to be tried enough. Stereoscopic networked performance systems can be surely established, and have been operated as mentioned in the previous paragraph. However, they generally require high costs and investment. This research examines the opportunity of stereoscopic networked live performance by proposing plausible minimal settings of stereoscopic networked live performance.

2. Related Works

2.1. Networked Performance

Naugle (2002) defined networked performance as a shared activity between two or more people with synchronous communication in performing arts. Although the term varies – telematic performance, cyber-performance, distributed performance and so on, it employs engineering techniques and equipment to connect distant locations and present artistic productions on virtually shared stages.

Researches on networked performance have been made in several viewpoints. Carôt and Werner (2007) classified networked performance into six groups and offered key play characteristics of each approach in terms of musical performance. Kurtisi et al. (2006) measured favored network delays in wide-area networks environment in a viewpoint of network engineering. They proposed the network delays of 30msec can be a generally usable boundary in networked music performance. Stockholm (2008) suggested an application system which supports networked performance of end-users in social settings. Likewise, Sarkar and Vercoe (2007) developed a systematic tool for networked performance which has prediction and learning capabilities of musical notes. These works provide solid foundation for networked performance research. As an extension of existing works, researches that enhance artistic expressiveness and systematic completeness of networked performance are needed.

2.2. Stereoscopic Methods

Stereoscopic methods – how to get 3D images – are broadly categorized into two groups. The first group of them is passive methods that do not require any special electronic devices to view stereoscopic. There are other methods, or active methods, which exploit dynamic devices to generate stereoscopic images. Some of the representative methods are briefly described below.

Complementary color anaglyph method, or anaglyph method, is the most traditional passive method to implement 3D vision. To generate stereoscopic image, original image on each side should be encoded in the two colors. A pair of complementary color – red-blue or red-cyan pair – on viewer's glasses creates binocular parallax and each eye percepts filtered image of them.

Passive polarized glasses method is another method which creates binocular parallax in different way. A mixture of vertically and horizontally polarized image is filtered through each side of glasses which have vertical and horizontal polarization lens. This method does not affect the colors of original image unlike the anaglyph method.

Shutter glasses method is one of active methods. With alternatively projecting vertically and horizontally polarized image, electronic glasses with dynamically synchronized shutter lens let each eye percept a different image at a time. Thus, this method requires more sophisticated devices to obtain high frequency alternative image and synchronize glasses and screen.

3. Approaches

3.1. Stereoscopic Networked Performance System

Fostering a minimal configuration without professional, broadcasting-quality and high-cost equipment, such as i-Visto (Takeaki et al., 2005) or intoPIX PRISTINE (Halák et al., 2010; Halák et al., 2011), can be a good starting point to introduce stereoscopic into networked live performance. In other words, establishing low-cost, especially research-purpose, stereoscopic networked performance system has its own value. This is not only because low-cost system is economically favored but also we can easily apply various manipulations and make experimental attempts upon the low-cost system. Mendiburu (2009) also intimated that 3D technologies and applications are moving from special venues to daily environment. This places considerable significance on simple and general approach to stereoscopic networked live performance.

Theoretically, stereoscopic networked performance could be achieved by directly applying one of stereoscopic methods mentioned in the previous section to existing networked performance. However, such an approach can be seen unrealistic at this moment, especially employing active methods. For example, shutter glasses are applicable and affordable enough to

be used on a 3D television in a living room, but not in a performance theatre as a public event venue. In addition, it might be hard to obtain high frequency to alternatively project left and right vision in networked situation. Therefore, general restrictions of networking and performance venues must be considered in constructing stereoscopic networked performance system.

3.2. Preferred System Features

Considering limitations of networking and general performance venues, three preferred system features for low-cost stereoscopic networked live performance were derived below.

- Anaglyph method for generation of stereoscopic - it can be easily obtained through simple image processing application and only requires simple traditional projection.
- Pre-processed manner - the final image product (anaglyph image) would be better if it synthesized before the transmission because it does not demand synchronization between the two transmission channels.
- Moderate frame rate and resolution - the highest quality of anaglyph image could exceed the capability of image processor and networks in theatres especially in live performance. Real-time video compression might help.

4. Results

Based on the preferred system features for stereoscopic networked live performance, an actual instance of the system was constructed and tested for live performance (Figure 1 and Figure 2). Two identical webcams were used for capturing binocular images. A simple image processing application written in Max/MSP/Jitter was used to synthesize the anaglyph image. The output was converted into digital input format and transmitted via VideoLan software over networks in UDP format. UDP packets were decoded by VideoLan on the other side and the final image was projected onto a screen. H.264 codec was used for real-time compression and 800x600 resolution was used for guaranteed performance regardless of the capability of networks.

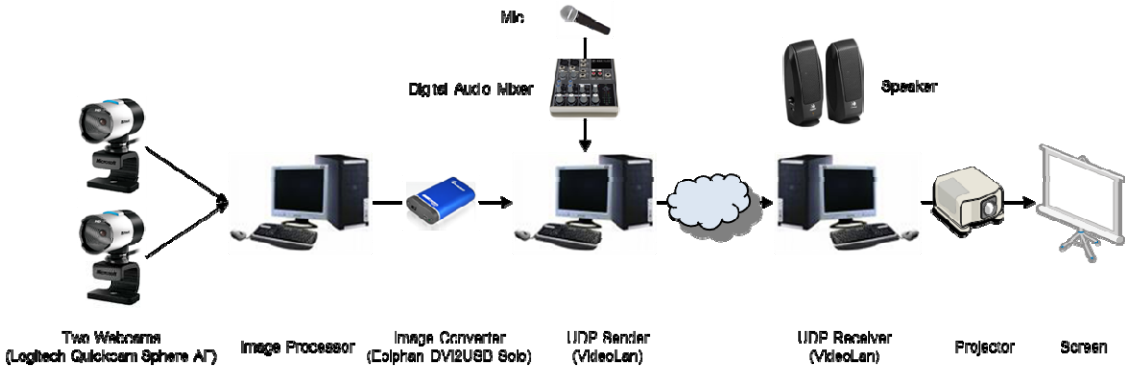

Figure 1. An example of system configuration for stereoscopic networked live performance

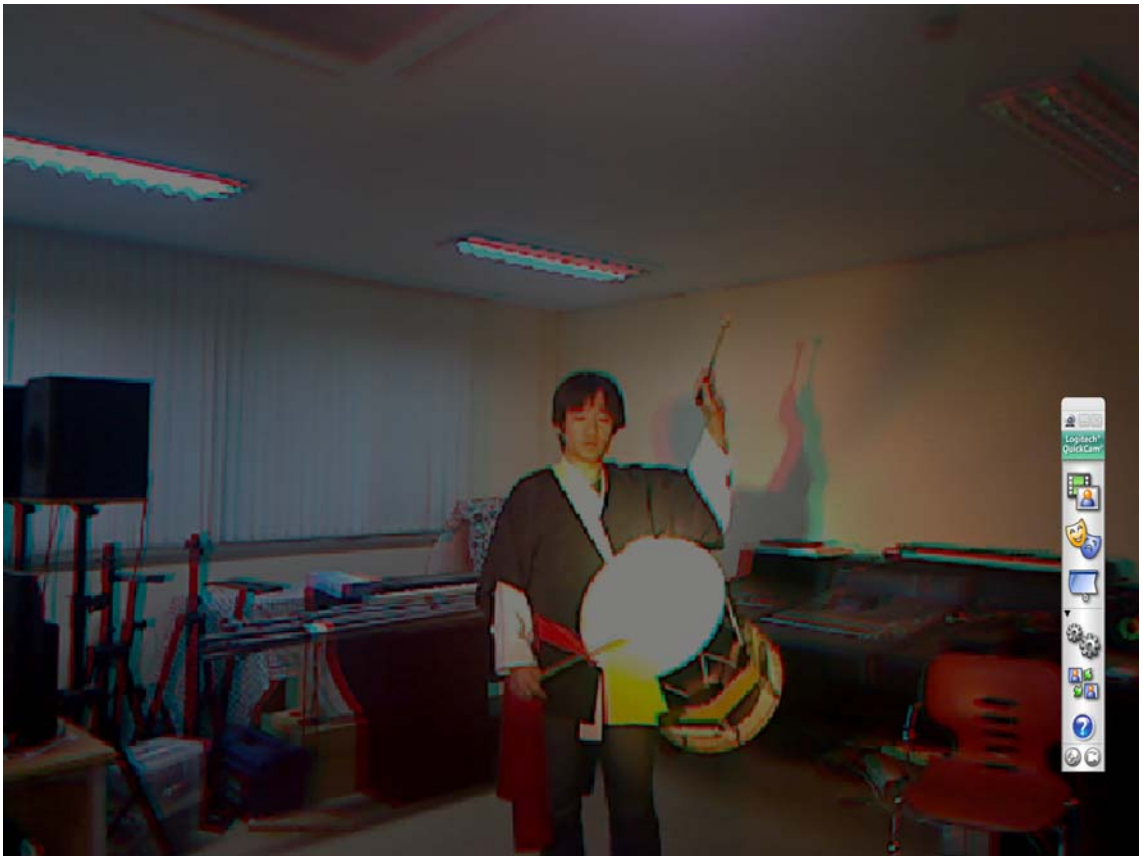

Figure 2. Screenshot of stereoscopic networked live performance (Korean traditional percussion performance)

5. Conclusion

This research tried to introduce anaglyph method into networked live performance to propose experimental configuration of stereoscopic. As a result, it was able to get moderate stereoscopic image for networked performance.

This research was not a demonstration of the cutting-edge technology to implement stereoscopic, but provided with an example of stereoscopic system configuration for networked live performance currently applicable with least resources. In addition, this paper has implication by examining the potential possibilities of presenting stereoscopic networked performance and limitations of introducing existing stereoscopic methods. Future works for enhancing quality of

image and transmission are required for practical use of stereoscopic networked performance in low-cost environment.

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