Design of Augmented Object Compositing System based on Diminished Reality

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Abstract. Recently broadcasting service providers are supplying the various broadcasting environments through virtual studio that uses small-scaled blue screen. However now that such services decreases the immersion of the users and cannot present the reality of broadcasting service. Therefore, in this paper, the improved augmented object synthesis system structure that uses the object removal technique that maximizes the reality was designed and suggested so that reduction of reality and immersion due to restriction of space and absence of contents.

Keywords: Augmented Reality, Image Compositing, Diminished Reality

1 Introduction

If watches the existing real-time internet broadcasting services, they have the problem that the immersion of service users decreases because the broadcasting is produced in the narrow space. Thus, broadcasting service providers are supplying the various broadcasting environments through virtual studio that uses small-scaled blue screen[1].

However, now that such services provide various broadcasting environments only through background image and cannot provide the suitable contents for the broadcasting, it decreases the immersion of the users and cannot present the reality of broadcasting service.

Therefore, in this paper, the improved augmented object synthesis system structure that uses the object removal technique that maximizes the reality was designed and suggested so that reduction of reality and immersion due to restriction of space and absence of contents can be solved regarding operation of private internet broadcasting by providing various broadcasting environments through chroma-key and synthesizing various contents to the images through marker-based augmented reality technique and removing marker provided to synthesis of image from the image.

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2 Design of Augmented Object Compositing System based on Diminished Reality

Fig 1 shows a diagram of design of augmented object compositing system based on diminished reality

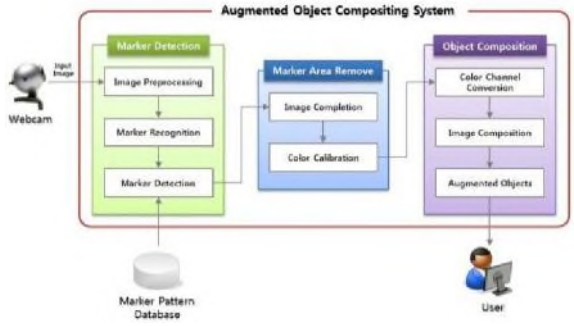

Fig. 1. Diagram of design of augmented object compositing system based on diminished reality

2.1 Maker Detection Module

2.1.1 Image Preprocessing. In order to detect the marker in the input screen, the image should be binarization. So, in this paper, the image is binarization using threshold selection method of Otsu[2] that binarization the image by performing bimodal distribution on frequency histogram.

2.1.2 Marker Recognition. 1st marker candidate region is set by performing labeling work in the binarization image. After that, 2nd marker candidate region is set by turning over the set the image of candidate region and re-implementing labeling work.

2.1.3 Marker Detection. After selecting one point among the detected facial shape information by detecting outline information using edge tracing algorithm[3] in marker candidate region, the corner point located at furthest distance from the point is extracted according to Pythagorean theorem. After that, the furthest corner point located from the extracted two corner points is extracted. After extracting three corner points, the remaining one point is extracted through Rect area expression. In order to match the marker in the set marker candidate region, the marker is detected by applying template matching[4] techniqueMaker Area Remove Module.

2.2.1 Image Completion. The region of the detected marker is removed by applying image completion technology that operates in the order like following figure to the input image. Marker region detected in the image that marker is detected is designated as the image completion region and the image is classified into the outline of image completion region and sample region for completing image. After that, the patch that has the highest priority is detected by considering reliability of patch center point and

the structure inside of patch among the patches take the dot on outline as the center. If finds the patch whose priority is highest, the patch that is most similar to the selected patch from sample image is detect. Image completion region is filled by copying the similar patch . The image is completed by repeating a serious of process as above.

2.2.2 Color Calibration. If projects the image that applies image completion technology, the problem that all colors of object removal region of input image and object removal region point of result image are arranged happens. Therefore, the image that calibrates the color is produced by using radiometric compensation[5] method that is one of color calibration technologies.

2.2 Object Composition Module

2.3.1 Color Channel Conversion. RGB color has the problem that it is weak for lighting when synthesizing the image. So, in this paper, image in RGB color space that performs image completion work is converted to the image in HSV color space using the following expression.

The range of ultramarine blue color is set in H channel that expresses the color that separates background area in ultramarine blue from the image of converted HSV channel.

2.3.2 Image Composition. The simplest way of separating background area from foreground area is to define the color of actionless background in single color in color space and designate the values included in the range as background area and the area other than the designated range as the foreground area[7].

The range of ultramarine blue color is defined as the threshold for binarization in order to separate foreground area from background area and the foreground area is separated from background area by binarization the image by threshold selection method of Otsu[4] and turning over the binarization image.

The information of HSV channel space for background area of the dualized image is converted into the information of RGBA color space and alpha channel information of the converted RGBA color space is analyzed. After completing alpha channel analysis of background area, alpha channel information of RGBA color of background image to be converted space is analyzed and synthesized with the image.

2.3.3 Augmented Objects. The distance between the marker in the image and camera and change of pose is estimated by using calibration technique that initializes the size of article that exists at specific distance from camera and the coordinates of 4 corner point of the detected marker is regularized into the coordinates system in virtual space. The article on the screen in virtual space is created and provided by implementing projection transform on the regularized coordinates system into screen coordinates systems of screen.

3 Conclusion

In this paper, the problem of low reality and immersion of the users who use the images produced through private broadcasting station-based virtual studio that uses the existing chroma-key was solved. It gave the users the immersion by applying augmented reality that utilizes that and chroma-key technique and augmenting 3D object in virtual space and the improved object synthesis system structure that applies diminished reality that the users can feel reality more by removing the marker in the image output through image completion technique.

It is judged that the speed of detecting the marker can be improved through the research that improves the processing speed of marker and it is expected that the improved system can be established by connecting it with augmented reality system accordingly.

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