

Advanced Virtual Studio

-Seamless image composition using actual and virtual studio sets-

With the aim of realizing richer video expression, STRL is developing an image-based virtual studio that combines an actual studio set with virtual studio sets, without incongruity.

Generally, in a conventional virtual studio, the actor is shot performing in front of a blue screen and a CG image is composed by inserting a virtual studio set into the blue area. While a virtual set has advantages in terms of its ease of adjustment, the space that it occupies, and cost in comparison with an actual studio set, it is not easy to generate a real-time virtual studio set whose picture quality is equal to that of the actual camera shot. The use of a blue background can especially be a problem, in that performers have a hard time acting in front of it, since there are no visual cues that the performer can use to create a natural looking interaction with the invisible characters and objects that are to fill the blue screen.

The real-space-based virtual studio, which STRL has test manufactured, is a system designed to solve such problems. Using this system, the actual studio sets necessary for shooting are shot with a camera that converts information about them into virtual studio set data. The studio is then disassembled; only the studio set pieces that will serve as acting prompts are left in the actual studio. After these preparations, regular shooting takes place. In outputting a composed image, the virtual studio set images are inserted, in real time, in place of the pieces of the studio set that were removed. This

system has the following characteristics.

- (1) Constructing only the studio sets necessary for the actors to play their roles contributes to an effective use of space and efficient studio set construction.
- (2) New types of video effects are possible with virtual studio sets supplementing real ones in segments where actual sets would have been impossible due to physical limitations, such as ceiling height or lack of perspective (as in viewing distant objects visible from a studio set window).



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As of this writing, we have constructed a prototype system using omnidirectional images as an example of a real-space-based virtual studio. Figure 1 shows the system flow. A camera shoots the entire studio set, the images of which are stored and then constructed as ultrahigh-definition omnidirectional images in a computer. The system thus has virtual studio set images for any viewing direction; it can create an image that appears to include the entire studio set, by inserting appropriate parts of the omnidirectional images into portions where the actual studio set has been removed.

Figure 2 shows an experiment combining the virtual studio concept with an Axi-vision camera developed by STRL and the resulting composition. The system could compose natural virtual studio set images, such as of a shouji screen or a backyard. The Axi-vision camera can simultaneously shoot ordinary color images and pick up depth information for every pixel in the images. By selecting the key images of real actors based on this depth information, the camera is capable of compositions that can vary the foreground-background positions of the omnidirectional images and CG characters, without the need of a special blue screen. Employment of an intelligent robot camera, programmed with a cameraman's shooting expertise, will eventually make possible natural virtual camerawork that accurately tracks invisible CG characters.



Figure 2: Virtual studio set experiment and composition results

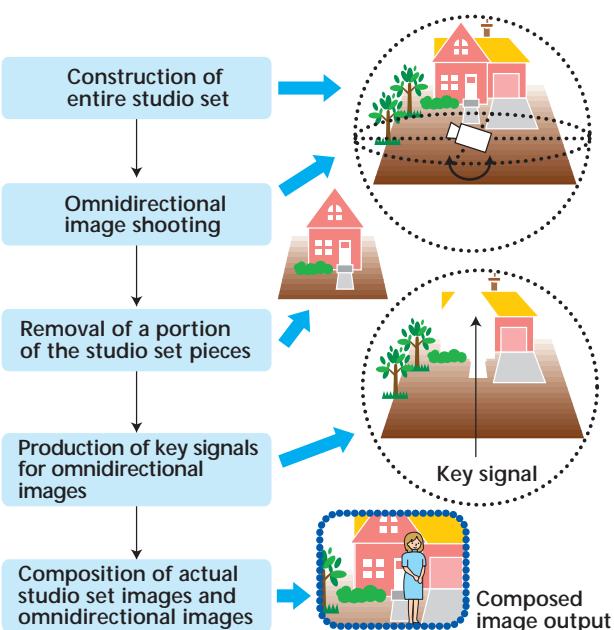


Figure 1: Real-space based virtual studio system flow

More study will be necessary on ways to easily generate scenes that exactly reflect the producer's ideas. This will include the construction of a virtual space supporting adjustable camera movements and varying lighting conditions.