Integral 3D TV system projects a promising future (w/ Video)

August 27 2010, By Lisa Zyga

This reconstructed 3D image was created using the integral 3D TV imaging system. Image credit: Arai, et al. (c)2010 IEEE.

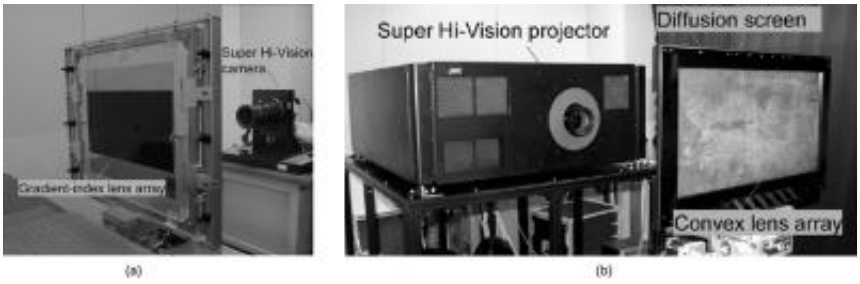
(PhysOrg.com) -- Critics of 3D viewing may call the technology a passing fad, but if engineers can overcome some of the challenges of today's 3D systems, 3D TV could work its way into becoming a common household product. There are several different ways to create 3D images on a display, and each has its own advantages and disadvantages. In one of the latest approaches, researchers from Japan have developed an integral 3D TV system based on the 100-year-old technique of integral photography that uses large numbers of lenses and pixels to transform ordinary photographs into 3D video.

The engineers, from NHK (the Japan Broadcasting Corporation) in Tokyo and JVC Kenwood Holdings, Inc., in Kanagawa, have been developing and improving their integral 3D TV system for the last several years. Their most recent system will be published in an upcoming

issue of *The Journal of* Display Technology.

One advantage of the integral 3D method is that, since it relies on a large lens array (400 lenses in the horizontal direction and 250 in the vertical direction), it doesn't require viewers to wear glasses and offers more viewing flexibility.

"The greatest advantage of our system is its suitability for the broadcasting system, i.e., glasses-free display, full-parallax (viewers can enjoy 3D images from any posture) and real-time motion imaging," Jun Arai of NHK told *PhysOrg.com*.



The experimental setup for (a) capturing video and (b) displaying video. Both steps involve a large array of convex lenses to generate a 3D effect. Image credit: Arai, et al. (c)2010 IEEE.

To record images, a large array of many convex lenses is placed in front of a Super Hi-Vision camera, which records the direction and intensity of light as viewed from slightly different directions. To display the images to a viewer, a Super Hi-Vision projector projects the images onto a diffusion screen, in front of which is an identical convex lens array. This set-up can recreate the direction and intensity of the light that was originally recorded. Since each lens looks slightly different at different viewing angles, the images look slightly different from different

directions, giving a 3D impression.

In terms of the image characteristics, there is a trade-off in the system in which an increase in the viewing angle results in a decrease in the image resolution. To maximize both characteristics, the researchers explain that it is necessary to shorten the distance between the lens array and the display device, and also narrow the pitch of the lenses, which requires a large number of pixels. Overall, the system uses a total of 7,680 pixels in the horizontal direction and 4,320 pixels in the vertical direction. With these adjustments, the researchers could ensure a viewing angle of 24 degrees and a spatial frequency that is 2.4 times higher than that of their previous system. Arai added that it should be possible to further improve both the viewing angle and image resolution with future research.

“The greatest challenges in improving this system are capturing and displaying a huge amount of information,” Arai said. “To maximize both [viewing angle and image resolution], in principle, a large number of pixels is required. Today, the large number of pixels and lenses required make this system complex and expensive to manufacture. This is a problem for manufacturing a consumer product. In the future, I predict the progress in mass production technology will solve this problem.”

More information: Jun Arai, et al. “Integral Three-Dimensional Television Using a 33-Megapixel Imaging System.” *Journal of Display Technology*. To be published. DOI:10.1109/JDT.2010.2050192

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