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The Interactive Multi-view Autostereoscopic Display and Measuring Spatial Dimension for Medical or Heritage Images

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Abstract

This paper presents some applications of a new interactive multi-view autostereoscopic display system to visual ergonomic, medical and heritage images. We developed it using a lenticular 20.1" LCD autostereoscopic display with highest definition/pixel resolution and also wide reproducing depth range with a priority among direct viewing autostereoscopic displays..

Key words: Interactive, Multi-view Autostereoscopic display, Measuring spatial dimension, Medical, Heritage image

1. Purposes

A stereoscopic image is effective for an observer to understand the 3D construction of an object image with intuitionalism and fidelity. This paper presents a new interactive and autostereoscopic display system, which allows an observer to control his/her viewing point to an image interactively to observe multi-view around an object, and to watch a surrounding scene around him/her [3,7]. The system was also applied to measuring visual ergonomic factors[4], and spatial dimension and angle with manual operation of a 3D pointer (3D cursor) in those stereoscopic images.

2. Design and experiments

This autostereoscopic display[1,2] consists of a 20.1"LCD panel and a lenticular plate for viewing a stereoscopic image with highest definition/pixel and widest field of view angle among direct viewing autostereoscopic displays at the present time. We preceded the minimum view number of 2 as highest picture quality/resolution and unnoticeable cross talk between left and right images as reproducing range in depth rather than multi-view format for wide viewing zone. The whole system is shown with **Fig.1**. The observer also controls a 3D cursor/pointer for pointing in the image space to measure spatial dimensions and angles of the image. The stereoscopic image is very useful for measuring a position of some images with even very week contrast (refer the surface of a tooth in **Fig. 3**), as the stereoscopic position is recognized clearly. The accuracy of the 3D pointer in depth/parallax is the same as original pixel pitch of 1.76 min arc, even though the stereoscopic image/pixel resolution becomes a half of the LCD panel pixel resolution, as the 3D pointer was drawn on a sub stereo-pixel method with a wide hand image, which allows to be binocular-fused easily and be gotten on steady positioning sense and a small point (finger), which allows to point precisely. Some other main specifications are shown in **Table 1**. This system is being applied to observe medical/anatomical-reconstructed images from micro

Table 1. The specifications of the NSLCD2000-5 interactive multi-viewing autostereoscopic display system

Items	*Type/Dimensions/Values*
Stereoscopic imaging method	Lenticular method with interleaved image
View number	Two views
Pixel number	H: 1,024/2(for one eye) V: 1,280 pixel
Pixel pitch, lens pitch	0.312mm(1.78min arc), 0.6211mm+-0.6211/512
Pointing accuracy in depth	1.78min arc resolution with sub stereo-pixel
Window format, size, FoV	Portrait, height 40cm x width 30cm, 30deg
Viewing zone, distance	Fixed (or tracked) zones of 65mm, 600mm
Inter angle of stereo views	6 - 6.5 deg. arc (60 views for around 360 deg)
Brightness	White 130cd/m^2, lighted room available
Cross talk ratio	0.017, unnoticeable among practical images

Computer Tomography[5], e.g. images of teeth shown in **Fig.2** and to evaluate also some heritage images[6], e.g. a reproduced images of the Great Buddha in Todaiji temple in Nara, Japan, built 1260 years before, the images of which were reconstructed with a geometric modeling using a multi laser range sensor system and with a photometric modeling. The CT method is one of some useful acquisition ways instead of some other ways e.g. a Range finder method.

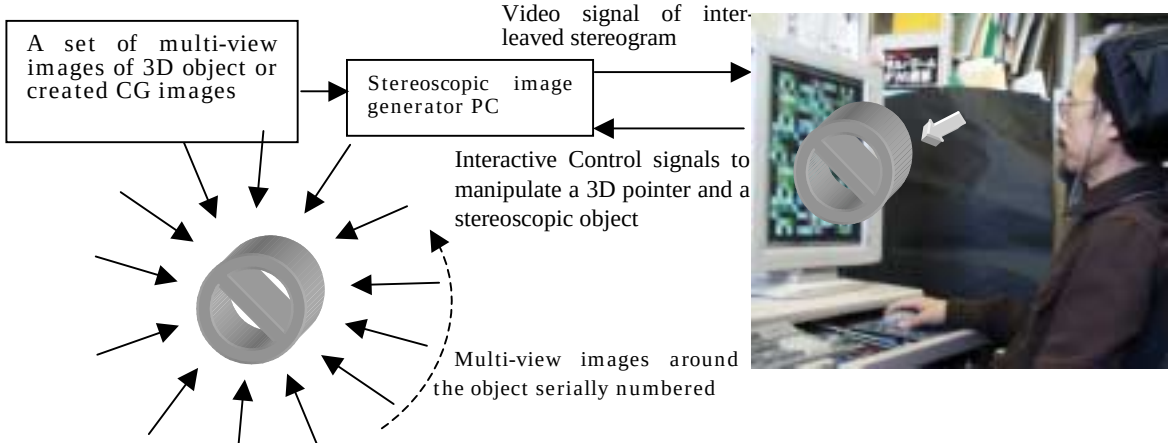

Fig.1 A diagram of the Interactive multi-view autostereoscopic display system, and a photo and synthesized images showing a figure of viewing a stereoscopic image on the display

3. Results and discussions

On some test observations of this interactive mulit-view autostereoscopic display system, any observers were able to feel very strong reality of objects with intuitionalism, especially during interactively manipulate the object, which was useful for him/her to understand the objects completely.

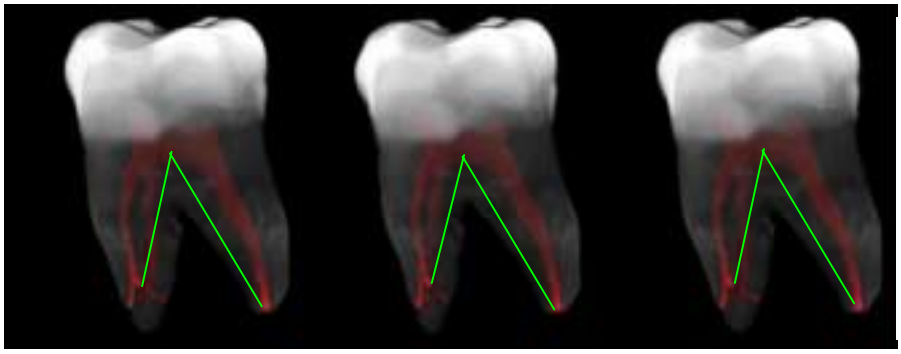

Fig.2 A set of stereogram of reconstructed images of a tooth from Micro Computer Tomography images with green lines for measuring distances and an angle in the image space (reconstructed by Onodera and Nozaka)

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