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A CASE STUDY TO RENDER COMPUTER GRAPHICS IN 3-D USING INTEGRAL PHOTOGRAPHY (IP) AND IMAGING

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ABSTRACT
This paper propose a review on Integral photography (IP) and imaging techniques. IP is the ideal technology of 3D printing material that embedded perspective image in both horizontal and vertical direction. IP and imaging overcomes the drawback in other conventional method by realizing the absolute. These geometric based systems were used in various applications. In this paper author presents the review on variants of IP with real time 3-D effect. By experimenting all these methods user can able to identify the suitable method as per their requirement. Results and discussion were given in line with the work.

INTRODUCTION
Image Based rendering is the technique in the field of Computer Graphics (CG), uses the real image has been attracting attention to attain image synthesis results in photo realistic quality. Conventional IP technology is a photographic technique, the NHK Science and technical Research Laboratory have demonstrated the effectiveness of High Definition Television (HDTV). Therefore some author uses IP images from HDTV camera as input, and interactively synthesizes and draws images from various perspectives [1].

MATERIALS AND METHODS
INTEGRAL PHOTOGRAPHY
To move the point of view continuously in any direction IP technology has been used. Ideal 3-D does not use the special glasses at the time of observation. To capture and display 3-D scenes with multiple eyes an array of micro lenses were used [2]. It is a technique of recording and reproducing light rays for each direction (ɵ,ϕ) at the position of each lens (x,y) as an element image. The gradient –index lens array (Optical fiber bundle) on the imaging side and the lens array that is set on the liquid – Crystal Display (LCD) panel on the display side corresponds to the microlens array of the conventional IP [3-5]. Diagram of the real time system is given in Fig. 1.

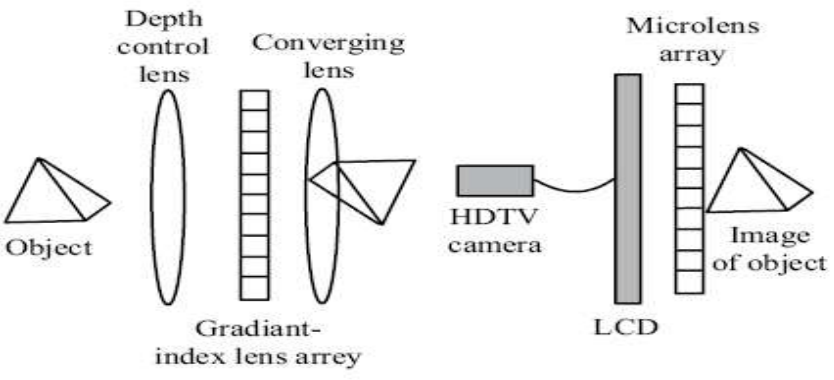

Fig 1. Diagram of real time IP system

IP technology principle originates in research of Dr. Gabriel lippmannin 1908. This process is remarked in the first place that the process is designed to work without a camera. It can provide full color, full parallax and

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continuous viewing images [6]. Dr. Lippmann has given the comparison of Integral photography with the lenticular lens 3D, HALS (Honeycomb Array Lens Sheet). That is given in Table. 1. It is inferred that the all round observant direction is possible only in Integral Photography.

Table 1: Lens array comparison with other

	Integral photography	Lenticular Lens 3D	HALS (Honeycomb – Array Lens Sheet)
Lens shape	Dots Lens	Cylindrical	Dots lens
3D principle	Binocular disparity	Binocular disparity	Binocular disparity& motion parallax
Observant direction	All round	Only Verticle lens Position	All round
Accuracy register	Strict all direction	Strict horizontal direction	At ease
Portion 3D	Still developing	Basically impossible	Can do it
Originality	No one can print	Popular	Portion lens by our technology

INTEGRAL IMAGING:

The Integral imaging consists of two process . i) Pickup, ii) Reconstruction. In pickup process of integral imaging , direction and intensity information of the rays coming from a 3D objects are spatially sampled by use of lens array (or pinhole array) and 2D image sensor. Process is explained by the author [7] and is sketched in Fig. 2.

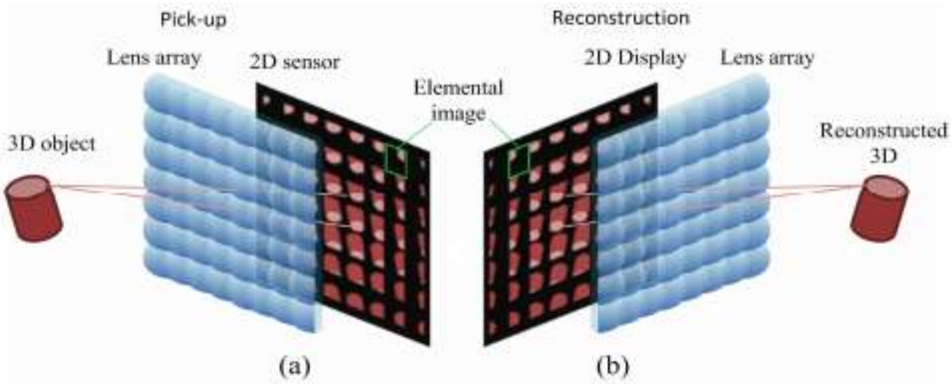

Fig 2 :Basic concept of integral imaging (a) Pickup , (b) Reconstruction

Consists of two process. i)Pickup and reconstruction.

INTEGRAL PHOTOGRAPHY AND IMAGING BASED WORK

INTEGRAL VIDEOGRAPHY IN MEDICAL APPLICATION:

MRI is the medical imaging technique commonly used in radiology to visualize the structure and function of the body. It provides much greater contrast between the different soft tissues of the body than compared to Computed Tomography (CT) does. A fast and accurate spatial image registration method was developed for interoperative Integral Videography (IV) image guided therapy by the author [8]. Preliminary experiments showed that the total system error in patient to image registration was 0.90±0.21mm, and the procedure time for guiding a needle to ward a target was shortened by 75%.Configuration of IV images Overlay navigation system, IV image display and overlay device, Registration of spatial 3D image in patient and software alignment for surgical navigation and IV image Overlay were discussed in materials and methods. Experimental results were tabulated. It is inferred that different operators could have individual differences in regard to their ability images/objects during the tests. Table 2 and 3 lists the results of the approach experiment using 2-D image guidance and IV image overlay by four operator for each of ten trials. Figure 3.shows the Images overlay of tumor, ventricle, and surgical tool onto the phantom of the human brain. The photographs show different steps of insertion of a simulated surgical instrument.

Table 2: Results of surgical tool approach experiment with 2-D image guidance

	ϕ 1.5		ϕ 2.0		ϕ 3.0	
Operator	Success	Time [sec]	Success	Time [sec]	Success	Time [sec]
A	60 %	17	80 %	18	100 %	12
B	0 %	31	60 %	33	100 %	34
C	60 %	29	60 %	32	100 %	25
D	60 %	25	100 %	16	100 %	31
Average	45 %	26±10	75 %	25±9	100 %	25±6

Table. 3. Results of surgical tool approach experiment with image overlay navigation

	ϕ 1.5		ϕ 2.0		ϕ 3.0	
Operator	Success	Time [sec]	Success	Time [sec]	Success	Time [sec]
A	80 %	5	80 %	6	100 %	5
B	20 %	7	100 %	7	100 %	7
C	60 %	8	100 %	5	100 %	7
D	80 %	7	100 %	5	100 %	4
Average	60 %	6±1	95 %	6±1	100 %	7±1

Fig 3. Images overlay of tumor, ventricle, and surgical tool onto the phantom of the human brain. The photographs show different steps of insertion of a simulated surgical instrument

IP COMPARISION WITH MULTIVIEW 3D IMAGING TECHNIQUES:

Multiview images can be displayed using Multiview (MV) and Integral photography (IP)are two similar contact types 3D imaging techniques. This paper [9] reveals that combined viewing zone of IP is not different from the viewing region between viewing zone forming optics and the viewing zone cross section of the MV viewing zone, in its characteristics. Basic optical geometries of MV and IP were given.

3D TV SYSTEM WITH CONTROLLED VIEWING PARAMETERS:

This paper presents a live 3D TV system , TransCAIP using an array of 64 video cameras and an integral photography display with 60 viewing directions. This work has got following features i) real time light field conversion, ii) Interactive control of viewing parameters. The author has given the literature survey on video based rendering, Autostereoscopic 3D displays and Live 3D TV systems [10]. The camera employs a built-in HTTP server, which sends motion JPEG sequences in response to HTTP requests from clients. The PC converts 64 input views captured with the camera array to an integral photography image consisting of 60 views. All of the conversion processes are implemented on the GPU using OpenGL and Cg. (C for Graphics). By using an array of 64 video cameras and an integral photography display with 60 viewing directions. The overall control is performed as a software process, without reconfiguring the hardware system. The proposed conversion method first renders 60 novel images corresponding to the viewing direction of the display. This light field conversion

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method not only enables the viewpoint conversion from the camera array to the integral photography display, also provides interactive control of viewing parameters. The process flow of the system is given in Fig. 4.

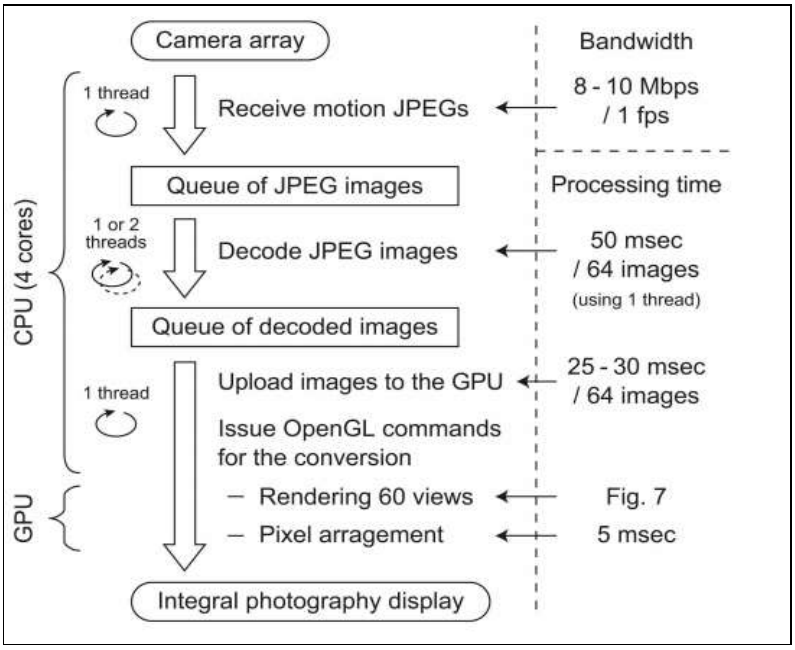

Fig .4. The process flow of our system and the processing time of each process.

3D COMPUTER GRAPHICS BASED ON INTEGRAL PHOTOGRAPHY:

The author discusses about ray based rendering and IP [1]. They given an evolution of IP technology. In detail author were discussed about spatial rendering with light-ray data. In proposed method author use a 57-row by 54-column array of element images. It is inferred that the proposed system can be positioned as a system that has larger number of eyes and a lower element image resolution than Video Based Rendering (VBR). They have discussed various methods to reproduce the image. In Method 1, each lens in the microlens array corresponds to one color. In Method 2 to synthesize a smoother image by linear interpolation of the colors of three contiguous lens. More sophisticated interpolation in which the depth of the object is assumed. Author investigated methods that apply complex processing by computer to achieve better image quality that can be achieved by methods that use special optics to reproduce 3-D images. Results of various methods are given in Fig. 5.

Fig. 5. Result of Method 1(res1.mov; 617 KB). Fig. 6. Result of Method 2(res2.mov; 329 KB).

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AUTOSTEREOSCOPIC 3D DISPLAY WITH INTEGRAL PHOTOGRAPHY:

By employing referential viewing area based CG image generation and pixel distribution algorithm for integral photography (IP) and Integral Videography (IV) imaging the images were created. CG image rendering is used to generate IP/IV elemental image. The author discusses about the CG based IP elemental image generation [11]. With the arrangement to view the 3D display the referential viewing area based elemental images rendering is given. The elemental images are rendered and reconstructed with CG. The pixel distribution calculation to distribute pixels to each elemental image is given through the formula, where X axis is horizontal, Y axis is vertical. Over sampling and pixel interpolation is used to increase the quality of the elemental images. The author discussed about the long visualization depth autostereoscopic display using system configuration and image recording procedure. They manufactured a prototype lens array frame with 105X70 bases for holding lenslets. The result is explained in Fig. 6.

Fig. 6. 3D computer graphics image produced by the IV autostereoscopic display for distant viewing, viewed from the left to right. The club stands out in mid-air on the palm of the viewer's hand about two meters away (yellow part) and four meters inside (red and green part) the display. (See supplementary Movie, which can be found on the Computer Society Digital Library at http://doi.ieeecomputersociety.org/10.1109

CONCLUSIONS

We have proposed a review on Integral photography and Imaging based applications. We investigated various methods used to achieve better image quality. The developed IV image overlay device can be used in surgical navigation, which enables a safe, easy, accurate surgical diagnosis and therapy. Yuichi Taguchi light field conversion method provides a general way for converting the different viewpoint layout between input and output devices and it is applicable to general combinations of camera arrays and integral photography displays. Position, color and brightness properties are defining pixel in a two dimensional graphic , a 3-D pixel adds a depth property that indicates where the point lies on an imaginary Z-axis. Novel technique for viewing autostereoscopic images with a long visualization depth is developed by the author Hongen et all. Author Jung young son et all were concluded that the sizes of viewing regions are critical to determine the super multiview condition.

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