Depth extraction of 3D object using axially distributed image sensor array

Min-Chul Lee [1], Kotaro Inoue [1], Naoki Konishi [1] and Donghak Shin [2]
[1] Dept. of Computer Science and Electronics, Kyushu Institute of Technology, Fukuoka 820-8502, Japan
Tel.:81-948-29-7699, E-mail: lee@cse.kyutech.ac.jp
[2] Institute of Ambient Intelligence, Dongseo University, Busan, 617-716, Korea

Integral imaging is a technique for obtaining depth information of 3D objects. It is composed of two processes: pickup and reconstruction. In the pickup process, we record the elemental images for 3D objects using a lenslet array and a camera sensor. In the reconstruction process, the recorded elemental images are used to reconstruct a set of 3D plane images through the computational reconstruction algorithm. One of the major problems in the integral imaging is to generate low resolution images due to the use of lens arrays. Thus, to overcome this problem, axially distributed image sensing (ADS) has been proposed [1]. It is an effective method for obtaining high-resolution depth information of 3D objects [2]. However, the motion parallax information is insufficient when the object is located in the center view of the elemental images. In this paper, we propose a axially distributed image sensor array (ADSA) system to improve the performance of depth extraction. The proposed method can be divided into two stages. The first stage is to get the elemental image array by using ADSA. The second stage is to reconstruct the 3D slice images using the recorded elemental image array.

Figure 1 shows the proposed image sensing system for ADSA. The detail experiment parameters were shown in Fig. 1. Objects were placed in the center of the image sensor array. Cameras were placed on a two-dimensional grid (8×8) with 7.5mm spacing. The ADSA was simulated by using the 3ds MAX program. The resolution of the recorded elemental image array was 5000×5000 pixels and each elemental image has 625×625 pixels. By moving the camera array with the interval of 1 mm, we recorded total 100 elemental images array. Then, we recorded 3D slice images using the computational reconstruction algorithm [2]. Figure 2 shows the results of the reconstructed images and the extracted depth image. The experimental results reveal that the proposed method can be effectively extract the depth information for 3D objects.

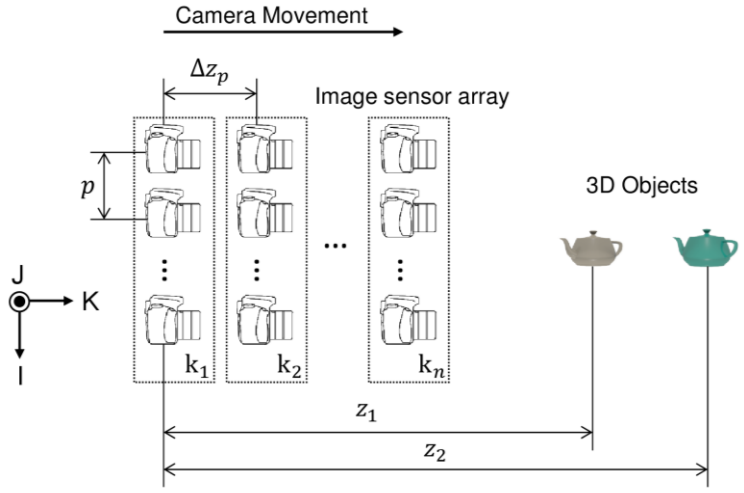

Fig. 1. Image sensing system for ADSA
Δz_p=1[mm], p=7.5[mm], z_1=650[mm], z_2=1100[mm], n=100

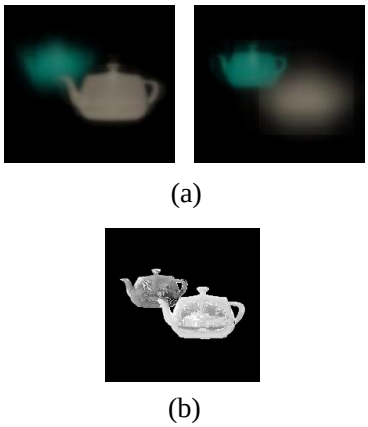

Fig. 2. Reconstruction Results
(a) 3D slice images. (b) Depth image.

References

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