

Gaze Contingent Depth Of Field Display

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Overview

A system in which an image captured using a light field camera is shown on a computer screen and refocused dynamically in response to the user's eye gaze location thus giving the illusion of focusing on near and far objects as experienced by the accommodation of the eye in real life.

Motivation

This project was selected keeping in mind the multitude of uses it could have especially in Virtual and Augmented Reality (VR/AR) applications:



- Increased realism of displayed scenes in Head Mounted Displays
- Lessened user fatigue due to a reduction in the vergence-accommodation conflict.
- Efficient bandwidth utilization by compression and lowered resolution of areas in peripheral vision.
- Improved interactivity and enhanced user experience in gaming and entertainment in VR applications.

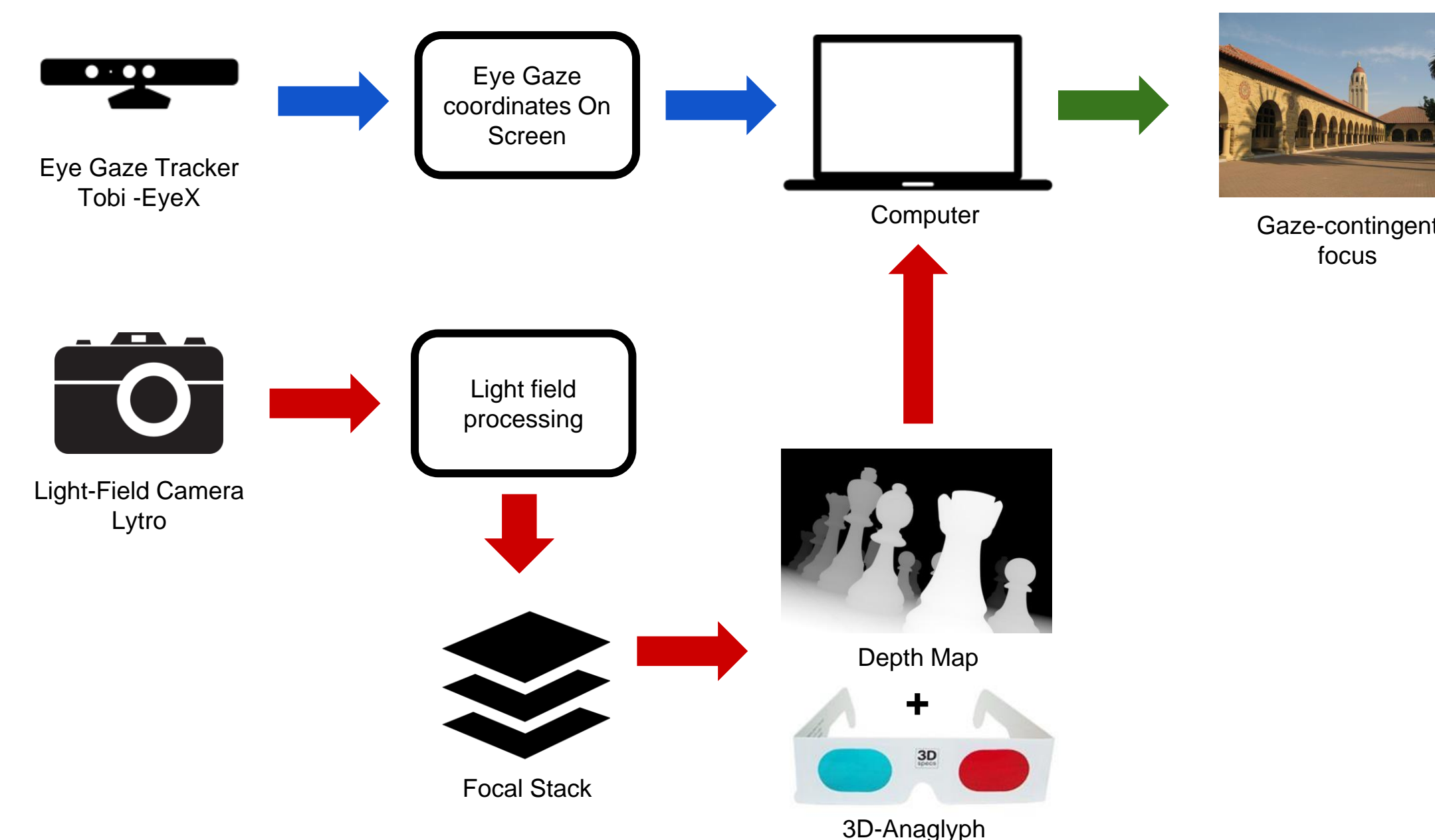
Related Work

[1] Mauderer, Michael, et al. "Depth perception with gaze-contingent depth of field." Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. ACM, 2014.

[2] Jacobs, David E., Jongmin Baek, and Marc Levoy. "Focal stack compositing for depth of field control." Stanford Computer Graphics Laboratory Technical Report 1 (2012): 2012.

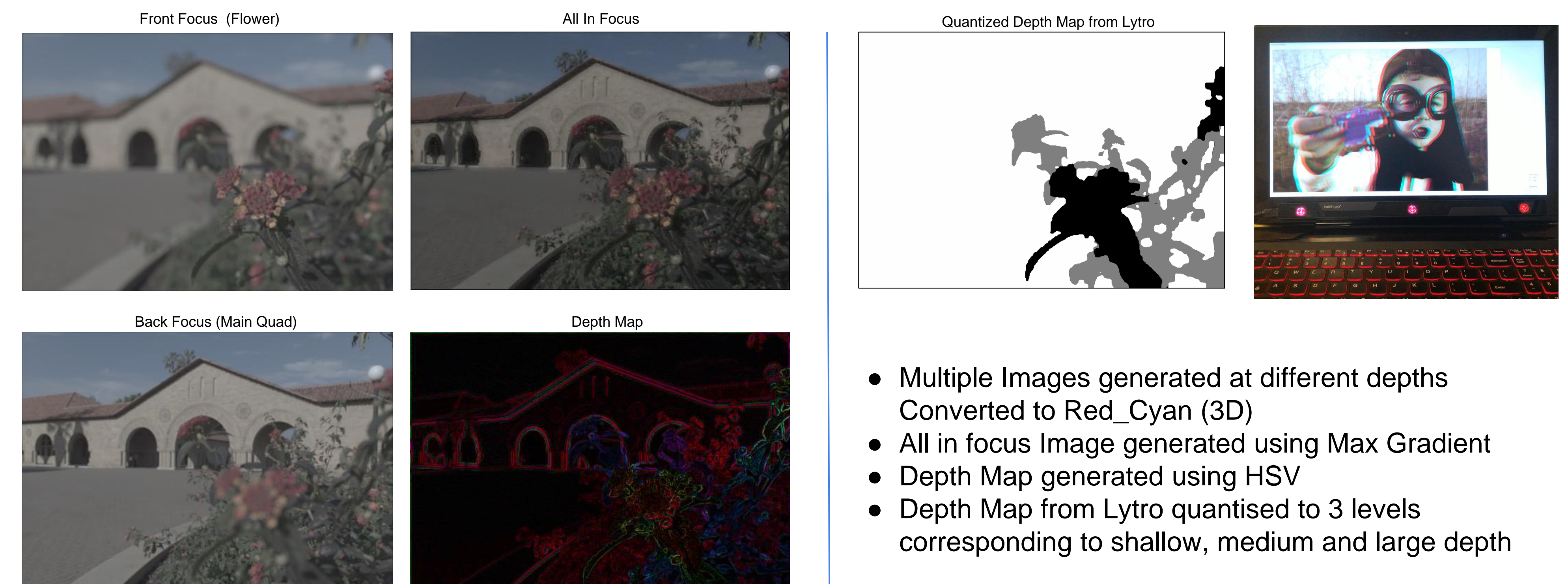
[3] "Duchowski, Andrew T., Nathan Cournia, and Hunter Murphy. "Gaze-contingent displays: A review." CyberPsychology & Behavior 7.6 (2004): 621-634.

Experimental Technique



- The eye tracker is calibrated for the user. This procedure is quick and one time only for each user assuming tracker position remains constant.
- Eye tracker interfaced with computer gives eye gaze location of user on the screen.
- Light field image from the Lytro camera is processed to obtain the focal stack, depth map and a red / cyan (anaglyph) image.
- Based on the eye gaze location a corresponding depth is chosen from the depth map and the slice from the focal stack focused at that depth is displayed on screen..

Experimental Results



- Multiple Images generated at different depths Converted to Red_Cyan (3D)
- All in focus Image generated using Max Gradient
- Depth Map generated using HSV
- Depth Map from Lytro quantised to 3 levels corresponding to shallow, medium and large depth