

Adjustable Aperture with Liquid Crystal for Real-Time Range Sensor

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Abstract : An adjustable aperture using a liquid crystal is proposed for real-time range detection and obtaining images simultaneously. The adjustable aperture operates as two types of aperture stops which can create two different Depth of Field images. By analyzing these two images, the distance can be extracted from camera to object. Initially, the aperture stop has large size with zero voltage. When the input voltage is applied, the aperture stop transfer to smaller size by orientational transition of liquid crystal molecules in the device. The diameter of aperture stop is 1.94mm and 1.06mm. The proposed device has low driving voltage of 7.0V and fast response time of 6.22m. Compact size aperture of $6 \times 6 \times 1.1$ mm³ is assembled in conventional camera which contain 1/3" HD image sensor and focal length of 3.3mm that can be used in autonomous. The measured range was up to 5m. The adjustable aperture has high stability due to no mechanically moving parts. This range sensor can be applied to the various field of 3D depth map application which is the Advanced Driving Assistance System (ADAS), drones and manufacturing machine.

Keywords : adjustable aperture, dual aperture, liquid crystal, ranging and imaging, ADAS, range sensor

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