

EVALUATION OF THREE-DIMENSIONAL ENDOSCOPE USING COMPOUND EYE OPTICAL SYSTEM WITH MULTI-WAVELENGTH BAND-PASS FILTER

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ABSTRACT. *Diagnosis and intervention in endoscopy are based on image sequences of a video camera. However, an image sequence provides no depth information. We propose the novel endoscope system with compound eye and wavelength band pass filter. The system is composed of micro-lens array, wavelength band pass filter, separation layer and image sensor. Several wave length band pass filters are covered with each micro-lens. The proposed system makes it possible to take any images from the membrane surface to deep blood vessel simultaneously. With several test targets, the characteristics of the prototype system are evaluated.*

Keywords: Multi-wavelength imaging, Optical band-pass filter, Compound eye optical system, Three-dimensional imaging

1. **Introduction.** Endoscopy is the examination and inspection of the interior of body organs, joints or cavities through an endoscope. The most benefit of Endoscopy is that it reduces the need to perform open-surgery. In addition, providing a powerful channel for visualization, it allows for closer examination of internal abnormalities such as cysts, liver cirrhosis, bleeding bronchitis, cancer and other diseases and conditions. Endoscopy has also revolutionized surgery by opening the doors to the extraordinarily convenient concepts of out patient and ambulatory surgery. Consequently, reduction in after surgery care and observation, lowered risks of infection and shorter patient recovery times have been some of its indirect benefits [1]. Diagnosis and surgical procedure in endoscopy are based on image sequences of a CCD camera. However, an image sequence provides no depth information. As the usual stereoscopic human sight is missing, navigation of instruments is very difficult. Operator 's experience only achieves a recognition and estimation of pathological structures, and estimation of their spatial extension. Diagnosis is very subjective. Calibration data and 3D reconstruction of pathological structures can make endoscopic diagnosis more objective and reconstructed [2-8]. This paper presents a system by compound optics and band pass filter array. We have developed the compound eye system called "TOMBO" (Thin Observation Module by Bound Optics) [9-11]. The TOMBO architecture has feature in system compactness and processing flexibility owing to combination of multiple imaging and three dimensional measurements and reconstruct. Also, the system is able to take images closely, because the diameter of lens is very small.