

## Multiple Target Warning through Millimeter Wave Radar and RGB-Depth Sensors

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### Abstract

It is very difficult for visually impaired people to perceive and avoid obstacles at a distance. To address this problem, we propose a sensor fusion system, which combines the RGB-Depth sensor and millimeter wave radar sensor, to perceive the surrounding obstacles. The position and velocity information of the multiple target are detected by the millimeter wave radar based on the principle of frequency modulated continuous wave. The depth and position information of the obstacles are verified by the RGB-Depth sensor based on the MeanShift algorithm. The data fusion based on the Joint Probabilistic Data Association algorithm and Kalman filter enable the navigation assistance system to obtain more accurate state estimates compared with using only one sensor. The non-semantic stereophonic interface is utilized to transfer the obstacle detection results to the visually impaired people. The experiment results show that multiple object with different ranges and angles are detected by the radar and the RGB-Depth sensor. The effective detection range is expanded up to 80 meters compared to using only the RGB-Depth sensor. Moreover, the measurement results are stable under diverse illumination conditions. As a wearable system, the sensor fusion system has the characteristics of versatility, portability and cost-effectiveness.

### Biography:



**Ningbo Long** was born in China in 1989. He received the M.S. degree from Tianjin University in 2015, and is currently a Ph.D. candidate at the College of Optical Science and Engineering, Zhejiang University, China. His current research interests are the small and short range radar systems.



**Kaiwei Wang** received his BSc and PhD degree in 2001 and 2005 respectively, both at Tsinghua University, Beijing, China. He joined the Centre for Precision Technologies, University of Huddersfield, in October 2005 as a postdoctoral Research Fellow under the support of International Incoming Fellowship awarded by the Royal Society and then by EPSRC of UK. From 2009, he has been working with Zhejiang University as an associate professor. To date his research has been primarily concerned on intelligent guide for the visually impaired.