Title:	Fast Volume calibration and Occlusion Free Depth Estimation using Enhanced Optical Orthogonal Codes
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Abstract: The structured light technique has been receiving increased attention for depth estimation as it is fast and robust. In this thesis, a new method for calibrating the camera-projector system required for structured light based depth estimation is proposed. The proposed calibration technique called the space calibration is simple and fast compared to the current camera projector calibration techniques, in the number of calibration images required and in the computation power involved. Among the various coding techniques available to encode the pixels of a image with unique address, hierarchical orthogonal codes are used in this thesis as they have better cross-correlation properties and are robust to ambient lighting conditions. Enhancements to this coding technique are also proposed. As the decoding procedure used in this coding technique depends on the likelihood of occurrence of a code, given the pixel intensities in a set of images, random codes get assigned in the shadow regions where an all zero code is expected. Owing to this, a self occlusion detection method is proposed to detect such shadows in advance and to suggest the readjustment of the camera-projector positions until the shadows get eliminated. As temporal codes, including hierarchical orthogonal codes, are susceptible to even slight disturbances in the position of either camera or projector, an address transition rule is proposed to correct any erroneously detected code at a pixel, based on the codes detected at its neighboring pixels. The proposed method is evaluated by computing the depth maps of objects of different known shapes.

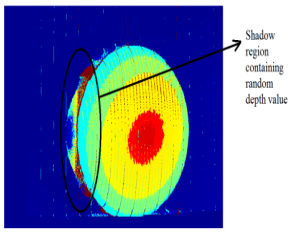

Fig. 4.3 Depth Image with outliers in shadowed region

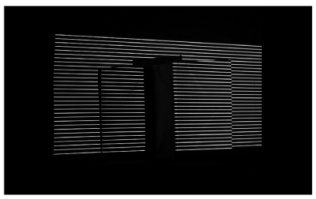
Fig. 4.8 Occlusion Test : Object Illuminated with Horizontal White Lines

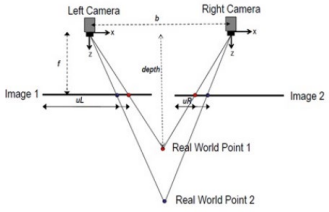

Fig. 4.15 Disparity value comparison for different real world points


Fig. 5.3 Background Plane with test object in front

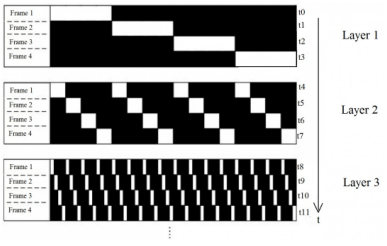

Fig. 4.1 Hierarchical Orthogonal Codes with **H** = 4 and **L** = 3

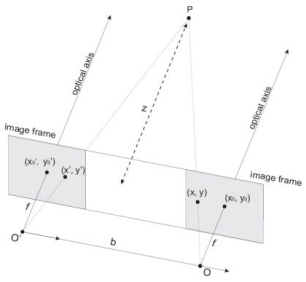

Fig. 4.14 Disparity Example


Fig. 5.1 Final experimental setup with the background, projector and camera


(a) Original image


(b) Projective transformed image