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Modelling the Xbox 360 Kinect for visual servo control applications

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ABSTRACT

There has been much interest in using the Microsoft Xbox 360 Kinect cameras for visual servo control applications. It is a relatively cheap device with expected shortcomings. This work contributes to the practical considerations of using the Kinect for visual servo control applications. A comprehensive characterisation of the Kinect is synthesised from existing literature and results from a nonlinear calibration procedure. The Kinect reduces computational overhead on image processing stages, such as pose estimation or depth estimation. It is limited by its 0.8 m to 3.5 m practical depth range and quadratic depth resolution of 1.8 mm to 35 mm, respectively. Since the Kinect uses an infra-red (IR) projector, a class one laser, it should not be used outdoors, due to IR saturation, and objects belonging to classes of non-IR-friendly surfaces should be avoided, due to IR refraction, absorption, or specular reflection. Problems of task stability due to invalid depth measurements in Kinect depth maps and practical depth range limitations can be reduced by using depth map preprocessing and activating classical visual servoing techniques when Kinect-based approaches are near task failure.