CALIBRATION OF A STEREO SYSTEM COMPOSED OF INDUSTRIAL CAMERAS AND FISHEYE LENSES

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ABSTRACT:

Pose estimation is used for different applications like indoor positioning, simultaneous localization and mapping (SLAM), industrial measurement and robot calibration. For industrial applications several approaches dealing with the subject of pose estimation employ photogrammetric methods. Cameras which observe an object from a given point of view are utilized as well as cameras which are firmly mounted on the object that is to be oriented. Since it is not always possible to create an environment that the camera can observe the object, we concentrate on the latter option.
First experiments have been done to assess the accuracy potential of a system consisting of two 5 Megapixel industrial cameras fitted with two different wide angle optics.

In this context also the use of fisheye lenses need to be investigated. The severe distortions that typically appear in images acquired by cameras with fisheye lenses can be largely handled by the choice of appropriate projection models (for example equidistant, equisolid-angle, stereographic and orthographic projection). In recent years several approaches have been published dealing with fisheye lens calibration. Based on this knowledge, our contribution is to examine the usability of fisheye optics in a photogrammetric stereo vision system for pose estimation in an indoor environment. For this we combine two high-resolution industrial cameras, each with a 180 degree fisheye lens.

The article deals with the calibration of the cameras as well as the calibration of the whole stereo system. Furthermore, an experimental setup is described, that is suitable for the estimation of accuracies for 3D point measurements and pose estimation. For this purpose, an experimental platform was built, which allows the flexible and stable assembly of cameras to a stereo system. An additional focus is given to the problems that arise from the distortion of imaged circular coded targets.