Proposal for thesis work

New calibration procedure for laser triangulation in industrial environments

Background

Optimation develops and delivers vision-based measurement systems for the process industry across the globe. Many of these systems rely on high accuracy 3D data obtained by laser triangulation. This technique relies on accurate camera sensor calibration to obtain real world coordinates in millimeters. This calibration is usually performed by placing an object with known dimensions in the laser plane, identifying the key points in the image where the laser hits the object, and calculating a mapping between camera sensor location and millimeters.

Motivation

Currently, Optimation assembles and delivers many laser triangulation modules that are calibrated in a controlled environment. All systems will eventually need hardware replacement and as soon as the geometry between camera and laser has changed, a re-calibration needs to be performed. This can be a simple process using a single laser triangulation module, especially if only parts of the camera sensor needs to be calibrated. However, if multiple cameras are to be calibrated into the same coordinate system the procedure rapidly becomes more complex. A huge advantage is to have a calibration procedure that, with a single image, can perform full sensor calibration of all cameras sharing a laser plane.

Scope and deliverables

1. Design a calibration object for multi-camera full sensor calibration
2. Implement an algorithm to extract key points from image of calibration object
3. Calculate the mapping between sensor and real world (mm) coordinates
4. (Optional) Format the mapping to fit existing cameras used for laser triangulation
5. Evaluate the accuracy and precision of system calibrations using real measurements
6. Report and presentation at Optimation and the student's university

The thesis work will be carried out in either Optimation's Luleå or Piteå office. Optimation will assign one main responsible supervisor for the project, and we offer a competitive economic compensation for the work. The scope can be adjusted for one or two thesis workers.

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#machinevision, #lasertriangulation, #imageanalysis