Pakapoj Tulsuk 2014: A Novel Method for Extrinsic Parameter Estimation between a Single-Line Scan LiDAR and a Camera. Master of Engineering (Information and Communication Technology for Embedded Systems), Major Field: Information and Communication Technology for Embedded Systems, Department of Electrical Engineering. Thesis Advisor:
Assistant Professor Miti Ruchanurucks, Ph.D. 96 pages.

In this research, we present a new algorithm to calibrate the pose between a LiDAR and a camera. LiDAR in the thesis is a single line scan LiDAR. It scan its surrounding perimeter using a scan plane. The pose can be explained by a rotation matrix and a translation vector which describe the orientation and the position between the devices respectively. The calibration process estimate the parameters, the rotation matrix and translation vector, using perceived shared feature of each devices. The checkerboard is the feature because it can define easily in mathematic. The checkerboard are detected in the image using corner detection and LiDAR as a line since the intersection of planes is a line. The described geometry is realize into mathematic model, called a geometry constraint model. Therefore, the estimation model is introduced as the distance of the checkerboard scanned points and its intersection line.

The solution to solve the estimation model contains with two part, i.e. linear least-square and non-linear optimization. Linear least-square answer are used as initial guess for non-linear optimization since the acquired data have an uncertainty. The obtained answer is resolved according to rotation matrix properties, to achieve the answer that fit to the assumption.

The result shows that our estimation model is outperform that of Zhang and Pless. Our analysis shows that ours proposed model effectively estimates extrinsic parameters between a LiDAR and a camera.

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