Evaluation of 3D Model Accuracy for Automated Unloading of Containers

Introduction & Application Area

The RobLog project aims at developing methods and technologies facilitating the automation of the logistic process of unloading containers filled with loose standardized goods. A key challenge addressed in the RobLog system is 3D perception, which is the base for making autonomous decisions over the course of the unloading task. Thus, accurate and reliable range information is required at high refresh rates for successful operation of the system. The objective of this work is to evaluate the measurement accuracy obtainable with different integrated 3D sensors.

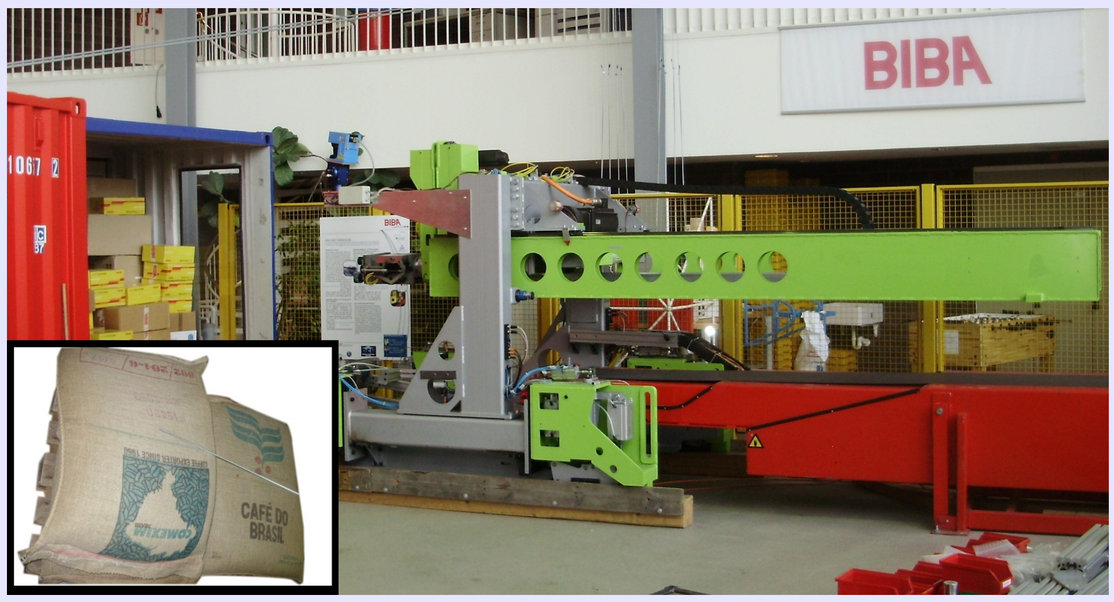

Figure 1: Application scenario considered: the parcel robot at the BIBA and sample sack-shaped goods.

Sensor Setup

The accuracy of three novel 3D range cameras was evaluated and compared to that of an actuated SICK laser scanner. Two time of flight cameras – the SwissRanger SR4000 and the Fotonic B70 and one structured light camera – the Microsoft Kinect were registered in a common coordinate system and compared to an actuated laser range finder.

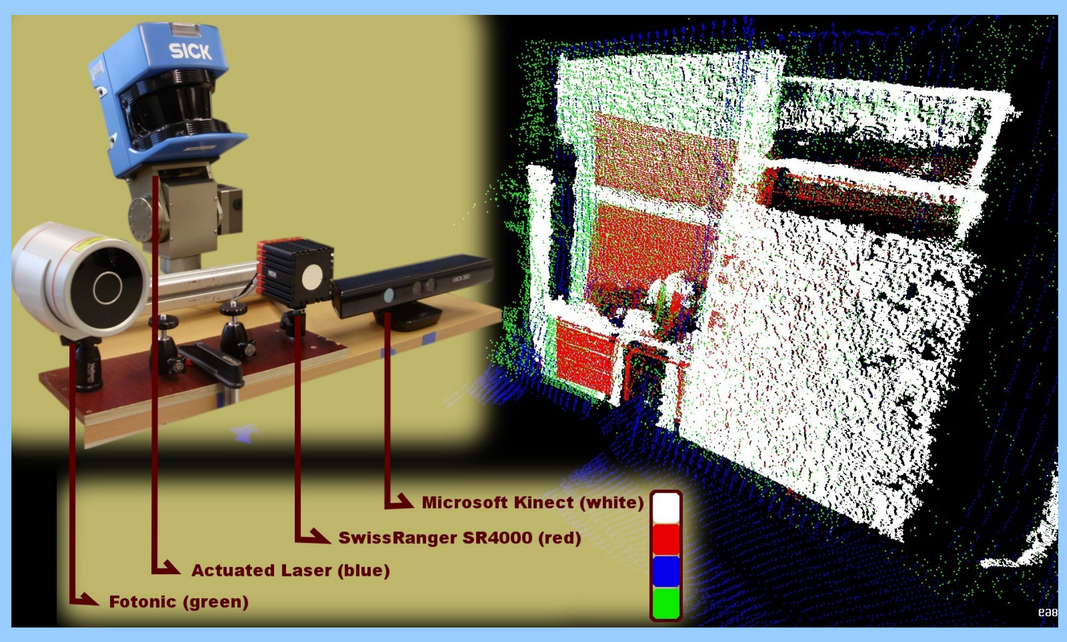

Figure 2: The sensor evaluation setup and sample point set outputs.

Evaluation Methodology

A set of point clouds from all four sensors was collected in an unconstrained laboratory environment. 3D-NDT models were constructed for each laser scanner point set. The readings from the other three sensors at each location were tested for likelihood based on the 3D-NDT models. For each data point, a corresponding point on a Receiver Operating Characteristic (ROC) plot was computed.

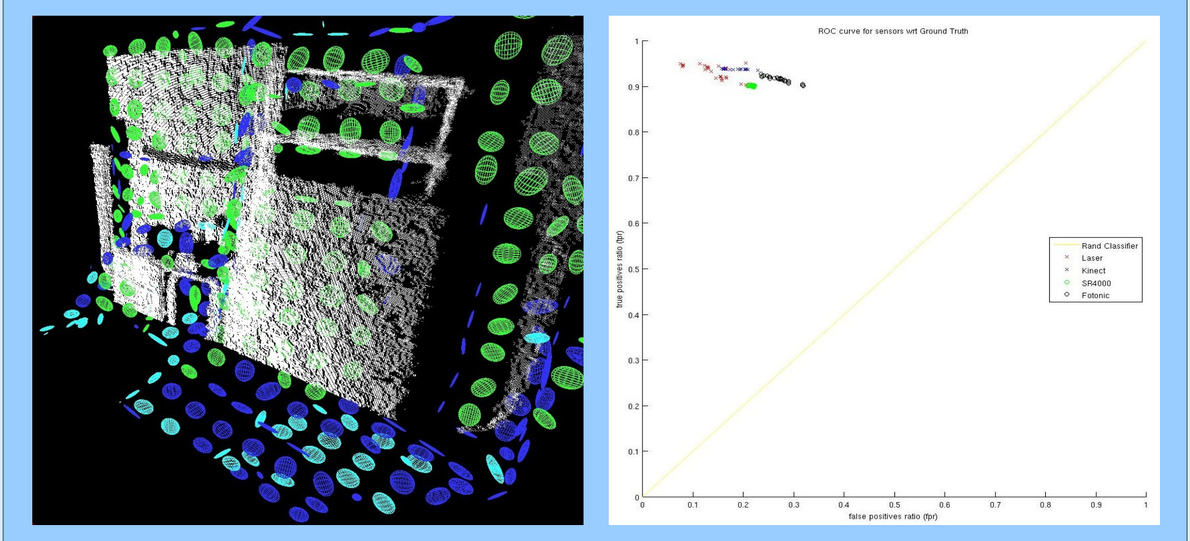

Figure 3 : Left – range data from Kinect and 3D-NDT from Laser. Right – ROC points for all scans in the test set

Discussion

A preliminary evaluation of three novel 3D range cameras was performed. The 3D-NDT was used as an underlying spatial representation in order to asses sensor accuracy. Further tests on larger data sets and more thorough analysis of the results will be pursued as future work.

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