Julius-Maximilians-
UNIVERSITÄT WÜRZBURG

A SENSOR SKID FOR PRECISE 3D MODELING OF PRODUCTION LINES

Jan Elseberg, Dorit Borrmann, Johannes Schauer, Andreas Nüchter, Dirk Koriath, and Ulrich Rautenberg

Objective & Challenge

- Increasing need of rapid characterization of environments in 3D like factories
- Yield high accurate 3D point clouds
- Digitalization without stopping the production
- Transfer the idea of mobile mapping to interiors
- Exploit existing conveyor belts for kinematic laserscanning
- Use no global references nor expensive IMUs
- Provide an efficient collision check with a CAD model moved along a trajectory

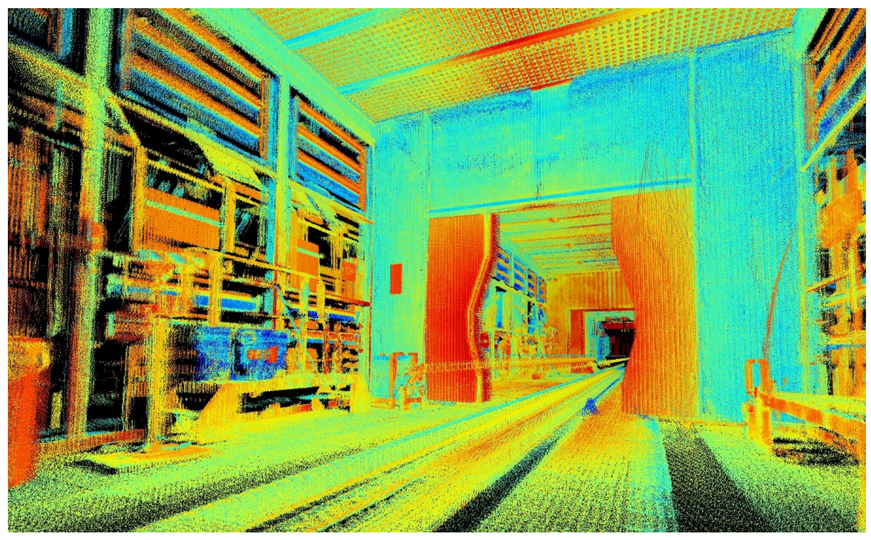
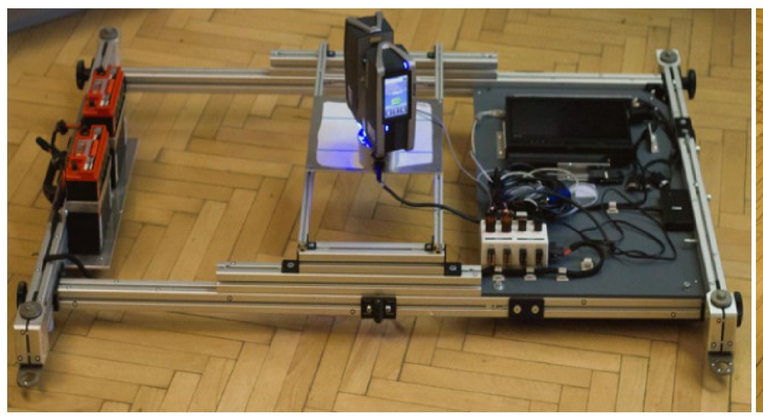
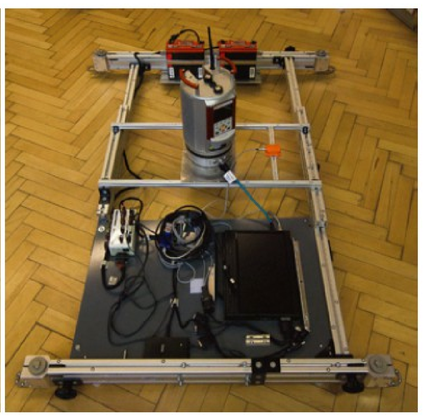


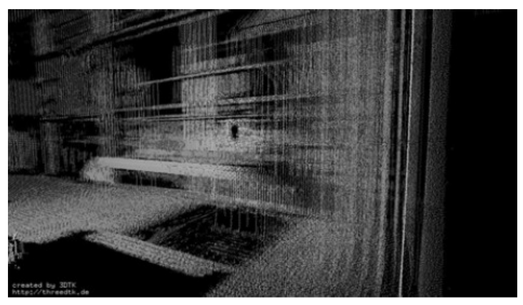
Figure: 3D point cloud of a Volkswagen factory

Approach

- Move a sensor skid (work-holding fixture) with a continously spinning laser scanner through the factory

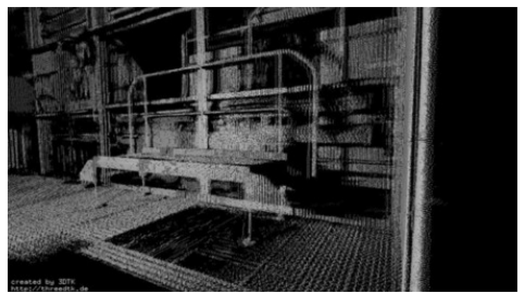






before SLAM

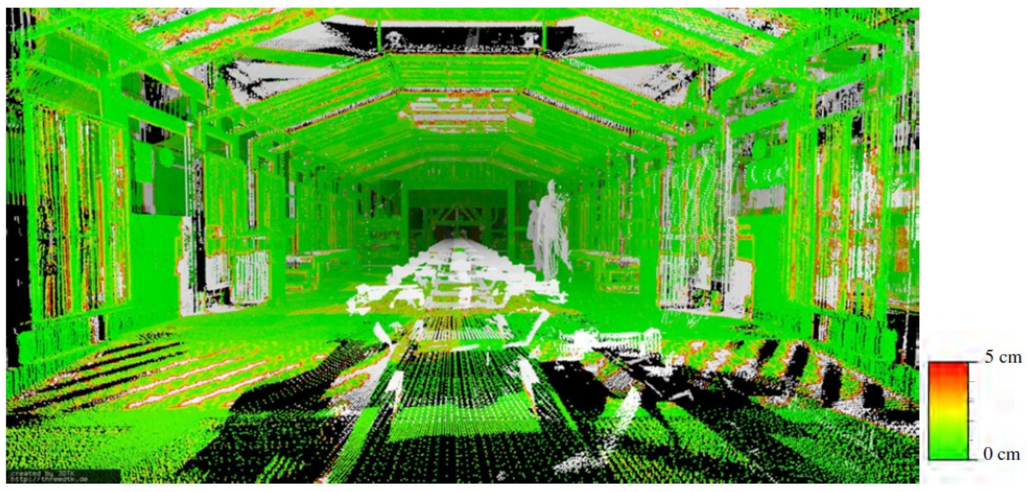
after SLAM



- Semi-Rigid SLAM (1) for deforming the trajectory

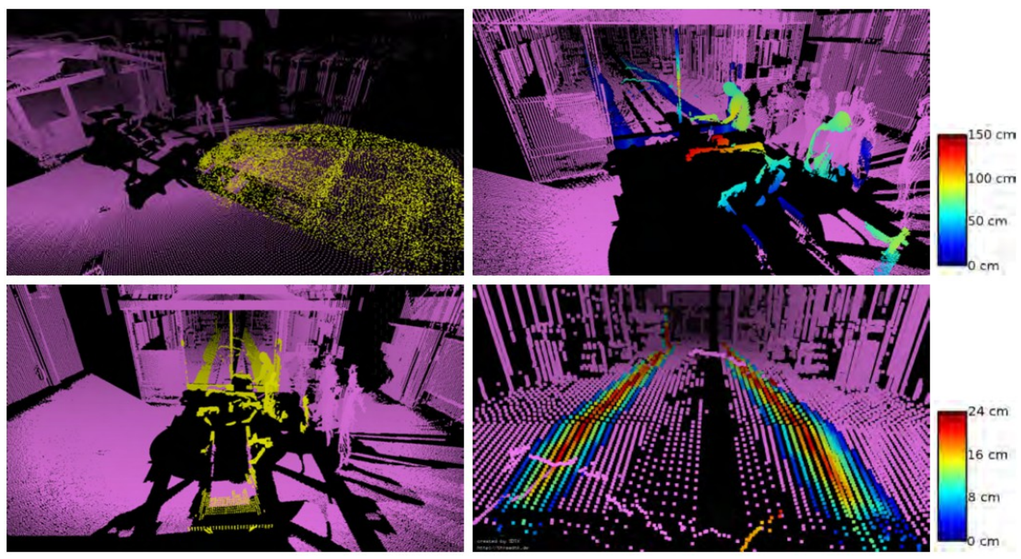
Results

- High precise 3D model
- Comparison with terrestrial 3D scanning



- Computation collisions using a fast k-d tree (2) and heuristic for depth of penetration

Figure: Upper Left: a view of two point clouds (environment and car). Lower Left: two separated point clouds (non-colliding and colliding points). Right Column: Color-coded depths of penetration



Future Work

- Improving the efficiency of the computation
- Enhancing the calculation of depth of penetration to regard that scanners gage surfaces
- Implement data acquisition for more scanners
- Ground truth analysis

References

(1) Elseberg, J., Borrmann, D. and Nüchter, A., 2013. Algorithmic solutions for computing precise maximum likelihood 3d point clouds from mobile laser scanning platforms. Remote Sensing.

(2) Elseberg, J., Magnenat, S., Siegwart, R. and Nüchter, A., 2012. Comparison of Nearest-Neighbor-Search Strategies and Implementations for Efficient Shape Registration. Journal of Software Engineering for Robotics (JOSER) 3(1), pp. 2 – 12.

Contact: Prof. Dr. Andreas Nüchter andreas@nuechti.de