Topic: 3D Scanning based Modeling in VR

Start: 03/01/2021

End: 03/07/2021

Task description:

3D scanning provides the foundation for remote exploration and co-working with industrial robots. Despite the plethora of 3d reconstruction systems, using 3D Scanning in a Virtual Reality environment for integrated acquisition and modelling is an upcoming research area. In this thesis, an interactive modelling framework in VR will be developed incorporating 3D scanning. The user can work interactively on the newly acquired 3D scans to build a model with high-level structural information. The implementation will be done in the CGV framework that supports basic functionality for immersive 3D Scanning.

Tasks:

* Literature review on fusion enabled 3D scanning approaches.
* Implementation of a basic user interface that allows to capture 3D point clouds from hand-held 3D scanners or rgbd cameras in a VR environment supporting file IO and calibration of VR and 3D scanner coordinate systems
* Integration of normal estimation approach and an existing point cloud registration algorithm to improve alignment precision.  
  Optional: provide user interaction to guide registration algorithm
* Extend user interface to support efficient marking of seed regions in current point cloud
* Develop algorithm that grows marked regions with speed adapted to surface features like curvature until regions touch itself along their boundaries.  
  Optional: provide user interaction to control grow speed and to correct region boundaries
* Develop algorithm to extract mesh topology from regions  
  Optional: implement approach to fit surface primitives or parameterized spline-surface to extracted regions
* Provide direct visual feedback for user interactions
* Evaluation of the implemented interactive immersive modeling scheme.

Optional:

* Incorporate strategies to deal with outliers and holes
* Combine resulting tool with immersive rigging tool.