IEC 61499 Coordinated Object Pose Recognition using ReconstructMe Technology

Gerhard Ebenhofer

ETFA 2012 – 4DIAC User's Workshop

LEADING
INNOVATIONS

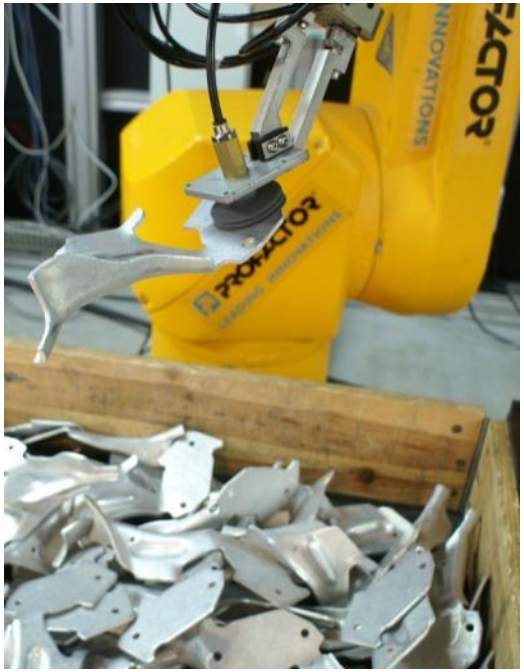
WWW.PROFACTOR.AT

Overview

- Introduction and Background
- ReconstructMe
- 3D Object Pose Recognition
- Integration in 4DIAC
  - Identified Problems and Solutions
  - Graphical User Interface (WxWidgets Integration in 4DIAC)
- Demo

Introduction and Background

- **Initial situation**
  - Parts are randomly disposed in a bin and are supposed to be separated and feed to a post-process in an a-priori known coordinate reference system.
  - Short cycle times and high accuracy of part deposition
  - High number of variants
- **Research approach**
  - Selection of proper grippers and configurations
  - Robust 3D recognition of parts
  - Dynamic process planning
- **Results**
  - **Flexible robot handling system**
  - Robust machine vision in the presence of noise, clutter, and occlusions
  - **Robust process planning**
  - Collision-free and singularity-free motions



Introduction and Background

- 4DIAC
  - is used for the integration of 3D object pose recognition and
  - manipulation planning in existing environments.

- 4DIAC allows simple integration of
  - Complex algorithms (e.g. for Vision and manipulation planning)
  - Hardware (e.g. linear axis)
  - Communication with Robots (KUKA, Stäubli, ABB, FANUC, FerRobotics, …) where each provides a different protocol
  - User Interface for human machine interaction

ReconstructMe

ReconstructMe

is an easy to use real-time 3D reconstruction system. (www.reconstructme.net)

Easy Handling

ReconstructMe's usage concept is similar to that of an ordinary video camera – simply move around the object to be captured. However, instead of a video stream you get a complete 3d model.

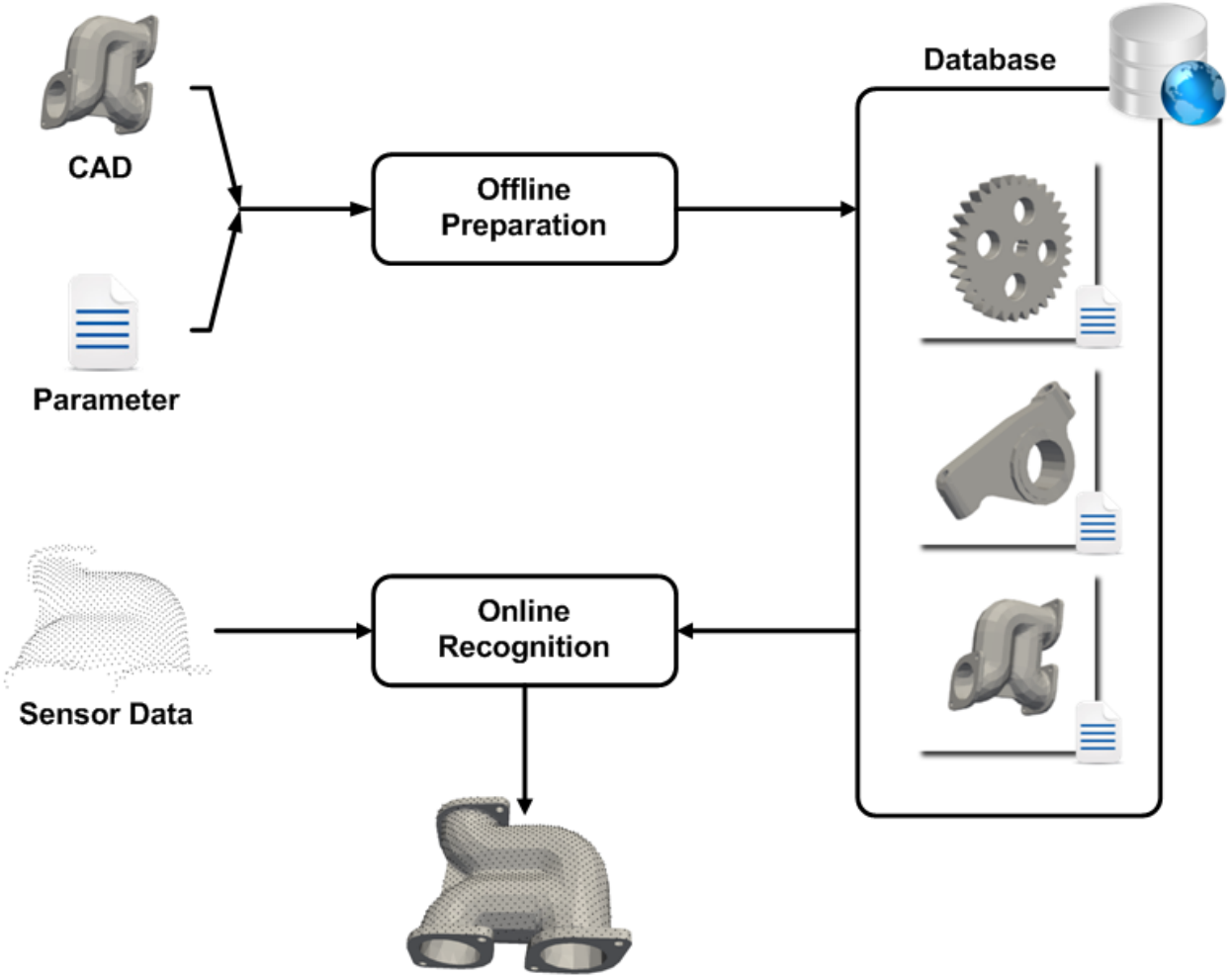
Across All Scales

Modeling with ReconstructMe scales from smaller objects such as human faces up to entire rooms.

Measurable Dimensions

ReconstructMe performs the entire reconstruction in metric space. No need for freaky scaling attempts. The result can be exported to various CAD formats such as STL, OBJ, 3DS, and PLY.

Object Pose Recognition - Concept



Integration in 4DIAC - Identified Problems

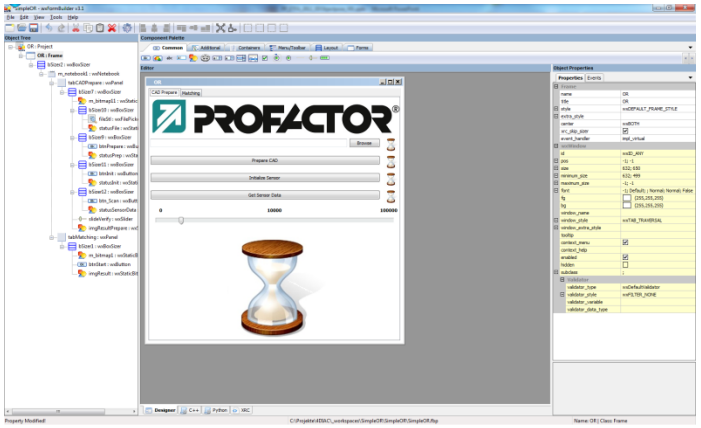
- Data types that are not (directly) supported by 4DIAC
  - point3f, matrix4f, …
  - **Solution**
    - Implementation of a basic set of custom data types
- Amount of data that needs to be exchanged between FBs
  - point cloud with e.g. 250.000 points
  - by default FORTE copies the data
  - **Solution:**
    - Introduction of a shared pointer data type which is based on boost shared pointer

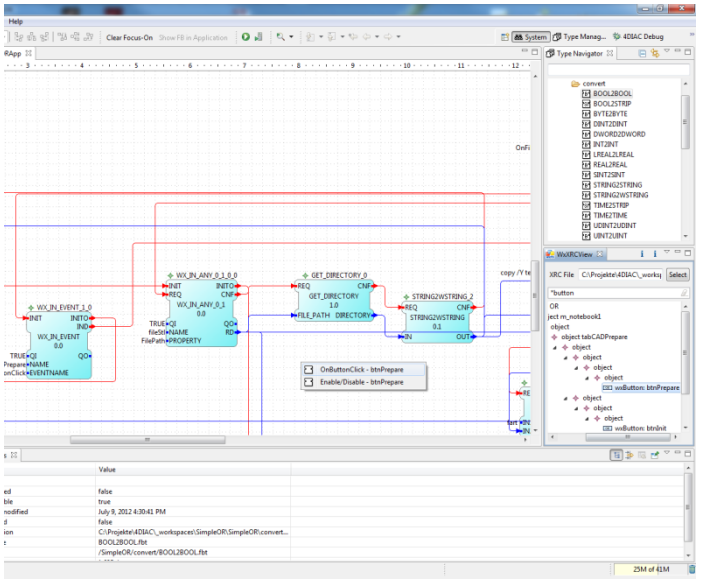
Integration in 4DIAC - Identified Problems

- Performance issues in FORTE serialization layer
  - **Solution(s):**
    - implementation of a compression layer (time for compression vs. shorter send time)
    - evaluation of different communication layer instead of the default FORTE IP Layer (e.g. MPI, **ZeroMQ**)
- User Interface for parameterization of the algorithms/process during runtime is required
  - **Solution**:
    - WxWidgets integration in 4DIAC

Integration in 4DIAC - WxWidgets

- WYSIWYG Editor (WxFormbuilder)
- Save as XRC (XML)
- Load in 4DIAC-IDE and create/parameterize UI FBs (Drag-and-Drop)
- Load in FORTE for UI Layout





Demo

- MS Kinect/Asus XTION Sensor
- ReconstructMe – for 3D reconstruction of a part
- 3D Object Pose recognition of the reconstructed part

Thanks for your attention!

Contact Speaker
Gerhard Ebenhofer
PROFACTOR GmbH
Im Stadtgut A2
4407 Steyr-Gleink, AUSTRIA
gerhard.ebenhofer@profactor.at
www.profactor.at