"Conversion and Integration of CAD-Data into Knowledge Base for Task Execution with a Service Robot"

Overview

The IAT is developing a software-framework called MASSiVE [Mar06] for the control of rehabilitation robotic systems like FRIEND II [FRIEND-II-WP]. The central motivation for the development of such a system is to provide disabled people (tetraplegics) with autonomy of at least 1.5 hours in the domestic or working environment in the future.

The motion planning in MASSiVE is based on a so-called MVR (Mapped Virtual Reality, [Feu05]) which maps real world objects that are in the current focus of manipulation into an internal representation. The MVR is used for distance calculation and collision prevention. Currently, the introduction of new objects into the MVR is done manually, by setting up MVR-object-data in a file or with the help of a MVR-specific GUI.

Goal

Within this project a method is to be developed that converts the output of CAD-programs into data-structures suitable for MASSiVE. Existing algorithms for the conversion of VRML files into MVR-data may be used. However, the necessary extensions are the opportunity to create parameterizable composed objects in the CAD-SW and to convert them. The final output shall be written to MVR-files as well as to data-structures (item prototypes) derived from MASSiVE’s item ontology (see Fig. 1). The item prototypes are then stored in MASSiVE’s knowledge base for task planning and are used to create item instances for task planning and execution [Mar05].

Fig. 1: Sample item ontology
Procedure

• For the creation of CAD-data “Blender” [BlenderWP] shall be used. The creation of simple and composed objects has to be learned. If not available a short introduction into the usage of Blender should be compiled.
• A special syntax has to be developed that supports the specification of parameters and object grouping (to create composed objects and sub-objects) with the means Blender provides.
• A conversion GUI shall be developed (in Qt, see [TrolltechWP]) that converts and verifies the CAD-data. The GUI shall provide the following functionality:
  • Writing to MVR-files and to item data structures from the item ontology (item prototypes).
  • Verify: Do the objects coming from CAD-data consist of one of the basic MVR-objects (cylinder, cuboid, sphere)? If not, the CAD-data has to be rejected with an appropriate hint to the user.
  • Verify: Is the parameter syntax correct, can it be interpreted?
• Design and implementation of the necessary classes.
• Testing of the implementation and documentation of the tests.
• Completion of documentation and presentation of the project.

Hints

• Documentation has to take place in parallel to the projects and is (beside regular meetings) an additional feedback to the supervisor.
• SW in the FRIEND-II-project has to be developed in C++ (therefore, good knowledge of object oriented programming in C++ is necessary [Str00]). The SW-design has to be done with the help of UML [UmlWP]. Furthermore, the doxygen-SW [DoxWP] is used during the design- and documentation phase.
• The IAT-programming guidelines (version August 2006) have to be respected; otherwise the implementations are hardly useful in the FRIEND project.

Literature & Links

[IATWiki] IAT Wiki-page http://www2.iat.uni-bremen.de/~friend2/iatWiki/
[MASSiVE-Doku] http://www2.iat.uni-bremen.de/~friend2/html/