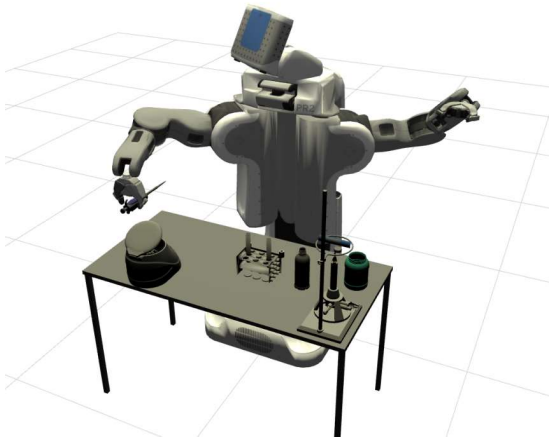
Expert Systems

- Practical Assignments -

Gerald Steinbauer
Institute for Software Technology
Inffeldgasse 16b/2
A-8010 Graz
Austria

Assignment



[OpenEase]

- implement an automated configuration tool for an autonomous robot
- model the knowledge as an ontology
- write an expert system in JAVA

Knowledge Engineering

- model the knowledge base as ontology
- model the description of
  - components: software, hardware, sensors, actuators, …
  - capabilities: navigation, perception, grasping, …
  - general concepts: geometry, …

Tips

- define all necessary concepts und roles (predicates, facts, rules)
- in order to minimize the effort for modelling, think about which general concepts and object hierarchies are possible, e.g. sensors of the same type have the same properties
- abstract spatial and temporal (action/effects) aspects: e.g. behind, left of, after

Tools and Resources

- model the knowledge base using description logic and the ontology editor Protégé (http://protege.stanford.edu/)
- the Jena Java semantic web framework (https://jena.apache.org/)
- SPARQL – a SQL-like query language for ontologies (integrated in Jena)
- start with the KnowRob Ontology (http://knowrob.org/ontologies/)

What to Do?

- model the knowledge base of the domain as ontology
  - representation of the autonomous robot domain
  - rules of the autonomous robot domain
  - individual entities
- implement a JAVA program that
  - is able to load the needed ontology(ies)
  - allows to specify a required set of capabilities/actions
  - derive a valid configuration for the given specifications

Process

- develop and test your solution
- work as team of max. 2 students
- submit only the source archive per email to steinbauer@ist.tugraz.at due 26.6.2019
- live discussion of the solution on 28.6.2019
- we will provide a online list to signup for a slot

Some Further Literature

- Moritz Tenorth, Koji Kamei, Satoru Satake, Takahiro Miyashita, Norihiro Hagita. *Building Knowledge-enabled Cloud Robotics Applications using the Ubiquitous Network Robot Platform.* In IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Tokyo Big Sight, Japan, 2013.
- Moritz Tenorth, Alexander Clifford Perzylo, Reinhard Lafrenz, Michael Beetz. *Representation and Exchange of Knowledge about Actions, Objects, and Environments in the RoboEarth Framework.* In IEEE Transactions on Automation Science and Engineering (T-ASE), volume 10, 2013.
- Michael Beetz, Moritz Tenorth, Jan Winkler. *Open-EASE — A Knowledge Processing Service for Robots and Robotics/AI Researchers*. In IEEE International Conference on Robotics and Automation (ICRA), Seattle, Washington, USA, 2015