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Master Thesis: Representing knowledge in a robot-agnostic ontology system for assistive robotics (m/f/d)

Your mission:

The Institute of Robotics and Mechatronics is developing intelligent service robots for applications in household and care-giving scenarios. These systems are expected to perform daily manipulation tasks that are simple for a human, but require careful planning in a robotic context [1]. One example can be placing and warming up a cup of liquid in the microwave: the robot has to leverage symbolic knowledge (like "there is a microwave", "it is open/closed", "there is a cup", and "the cup contains liquid") as well as geometric information (like the measurement of the cup, how large the microwave is, or how to push the buttons). It is relatively straightforward to use this information with one set of instances, namely one robot and a specific cup and microwave. However, we would like to represent knowledge in a way that the task scales to different instances, like a new microwave or a different robotic system. One way of representing such knowledge is using world models and **ontologies**.

The work can be divided into the following steps:

- Investigate about existing ontologies, like the Socio-physical Model of Activities (SOMA) from the University of Bremen.
- Refactor our existing knowledge database (known as the Object DataBase, ODB) into an ontology.
- Use the ontology to design tasks in the assistive robotics domain using our assistive robots.

Your qualifications:

- Studies in Computer Science, Mechatronics, Engineering, Machine Learning or a related field.
- Experience with Linux and Python programming. Knowledge in ROS and C++ is beneficial.
- And by the way: you will need to implement software on real robots – and not just simulations! Therefore, we expect you bring either experience with real systems, or the willingness to work and learn from hardware and middleware.

Your benefits:

You will have the unique opportunity to implement your research on the humanoid robot Rollin' Justin and the wheelchair-robot EDAN, which constitute two of the most advanced robotic systems worldwide. As such, we are looking forward to your contribution to cutting edge research in applied robotics! Our team consists of people with different backgrounds from all around the world, and we encourage having a diverse team!

Starting time: Autumn 2022. If you want to apply for the thesis, please contact daniel.leidner@dlr.de

[1] CATs: Task Planning for Shared Control of Assistive Robots with Variable Autonomy: <https://elib.dlr.de/186428/>



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