servicerobotik ZAFH

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Autonome Mobile Serviceroboter

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Service robots shall very soon autonomously provide services in all spheres of life. They have to execute demanding and complex tasks in a dynamic environment, collaborate with human users in a natural and intuitive way and adapt themselves to varying conditions. Acting in an everyday life environment imposes great demands on the engineering and development process. Although matured algorithms and solutions exist for subproblems, a methodology to open a systematic engineering approach for service robotic applications is still missing.
Thus, this project aims at developing a methodology for building service robotic systems. The major approach is to extend and merge separated techniques under the objective of suitability for daily use. The overall goal is to substantially facilitate development of autonomous mobile service robots.

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Adaptive intelligent control
(Prof. Dr. Ertel)

Practical experience shows that programming of advanced behaviour for mobile robots is extremely difficult and time consuming. Therefore it is crucial to relieve the developers as much as possible. One important way in this direction is the utilization of machine learning techniques. Rather than being programmed, the robots will autonomously learn at least parts of their behaviour. The „teaching-box“, one of the products of the project, will enable the robot to learn and the developer to support the learning process through human feedback and various other control options.

Verification of safety properties

(Prof. Dr.-Ing. Voos)
To enable the integration of autonomous robots in everyday life it is fundamental to provide evidence that certain safety properties and constraints are guarantieed at any case. A main challange is to deal with dynamic systems in changing environments.
For this purpose an analysis tool will be developed and tested.

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Software Technology (Prof. Dr. Schlegel)

Engineering the software development process in robotics is one of the basic necessities towards industrial-strength service robotics systems. A major challenge is to make the step from code-driven designs towards model-driven systems. The foundation for a model-driven software development approach (MDSD) in robotics shall be laid by a domain specific language that is defined as a UML profile and that is implemented in a MDSD tool chain.
A strict component based approach separates middleware aspects from algorithmic solutions and is thus essential towards reuse and composability of software building blocks. A special focus is put on service-oriented architectures for service robotics on top of QoS-middleware.

Localization / Mapping (Prof. Dr. Schlegel)

The scalability and robustness of probabilistic mapping and localization approaches depends foremost on the used sensors. In particular, substantial improvements are required as soon as range-only or bearing-only information is available. A focus is put on enhancements of probabilistic SLAM-approaches exploiting multi-modal sensory information.

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Information-optimized object recognition
(Prof. Dr. Wirnitzer)

Information-optimized object recognition implies reducing measured data to a minimum by real-time object classification. The reduction takes place very close to sensor at a early point in time. Standard image and signal processing algorithms and new adaptive methods are integrated to a toolbox.

Adaptive real-time image processing
(Prof. Dr.-Ing. Ihme)

State of the art automatic image processing systems are mostly designed for very specific applications. Often they are too inflexible. Recognizing coloured objects with arbitrary shapes in real-time is impletented via so called Anytime-Tasks. Processing output availability is enhanced with the help of predictive signal processing algorithms and Anytime-Tasks according to the slogan „better imprecise than no information“.