別紙４－１（課程博士（英文））

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Abstract (Doctor)

Title of Thesis	Ontology-based Knowledge Management System with Verbal Interaction and Concept Learning for Home Service Robots

Approx. 800 words

Service robotics, which refers to assistant robots at home, has been gaining importance. Researchers are creating robots to accompany and fulfill the needs of older adults or disabled humans. Developing a service robot that can support people at home is still an open challenge that many researchers are targeting.

Service robots need skills and characteristics to be involved in the social environment of humans. Several factors, such as the interaction with humans, the response and speed, and the usefulness for their tasks, must be considered for service robots. Moreover, they need to learn and adapt to their particular house settings, make decisions, and behave accordingly.

The ultimate goal of this research is to create fully autonomous robots that help people at home in diverse ways. Therefore, it is necessary to provide the robot with different skills depending on the scenario facing, such as vision, language communication, or learning. While a service robot can be equipped with the general knowledge and skills to cope with the most common situations at home, it also might encounter new scenarios, and hence, it must know what to do in such a case. For a service robot, learning a new concept by itself is a crucial factor.

The contributions of this research are focused on the development of a system for service robots performing tasks at home and are divided into two main components. The first component is building an Ontology-based Knowledge Management System with Verbal Interaction for Command Interpretation and Execution by Home Service Robots.

We develop a system for service robots that combines ontological knowledge reasoning and human–robot interaction to interpret natural language commands and successfully perform household chores, such as finding and delivering objects. We use an ontology to represent the general information of the components in the environment and their relationships; moreover, the system links natural language commands, the ontology object representation, and the real objects' information. The robot disambiguates uncertain requests through spoken interaction with the human before completing a task. It utilizes information from the ontological knowledge to create more precise questions.

The second component is realizing Ontology Learning of New Concepts combining Textural Knowledge, Visual Analysis, and User Interaction for Service Robots Applications. On this part, the robot is provided with another essential feature to adapt inside a home environment. We focus on the learning of new ontological concepts oriented to service robot applications. We propose combining textural knowledge, visual analysis, and user interaction to determine the correct placement of the new concept in the ontology structure. We aim to make the robot able to extend its ontological knowledge as needed. Moreover, the system's functionality and performance are demonstrated by experiments in a simulated environment.