



Ruhr Master School
of Applied Sciences

Dieses Wahlpflichtmodul ist ein Angebot der:

**Fachhochschule
Dortmund**

University of Applied Sciences and Arts

**Masterstudiengang Embedded
Systems Engineering**

Software for Robots

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Hochschule Bochum
Bochum University
of Applied Sciences



Fachhochschule
Dortmund
University of Applied Sciences and Arts



Westfälische
Hochschule
Gemeinschaften Bochum Recklinghausen
University of Applied Sciences

STIFTUNG
MERCATOR





Module Description for Block Week Module:

Module title	Software for Robots
Offering course of studies	Embedded Systems Engineering
University Campus	FH Dortmund
Language	English
Module representative/ Full-time lecturer	Prof. Dr. Christof Röhrig
Contact	Christof.roehrig@fh-dortmund.de

Abbreviation	Workload	Credits	Semester (WiSe/SuSe)	Planned group size	
MOD-E13	90	3*		minimum	maximum
				10	21
Courses/course types Attendance	Contact time		Self-study		
	Attendance during block week	Additional contact time during preparation and postprocessing e.g. videoconference	Guided during preparation and postprocessing	selfdirected	
	40	5	15	30	
Teaching types preparation	Online-Courses, Literature Research, Books				
Teaching types postprocessing	Online-Courses, Literature Research, Books				

* It is possible to purchase additional ECTS-points for extra accomplishments (see Notes)

Teaching results/ teaching goals/competences
<p>5.1 Knowledge</p> <ul style="list-style-type: none"> Knows typical challenges in developing software for mobile robots Knows how to use sensor and actuators on mobile robots Knows how to use computer vision, navigation and mapping tools/ methods/ algorithms <p>5.2 Skills</p> <ul style="list-style-type: none"> Can select and integrate typical tools used in robotics within software development projects Can implement software for mobile robots



- Can test and verify applications for mobile robots

5.3 Competence - attitude

- Can structure robotic systems design project
- Can communicate and find solutions with domain experts
- Understands issues from the robots application domains and can integrate solutions into a holistic design

Contents

Robotic systems are usually very complex and utilize extensive functions as well as a high amount of actuators, sensors, and software-algorithms. The development and maintenance of software for such a robotic system is a challenge for developers and requires robotic specific domain knowledge. As the field of robotics ranges from enormous industry robots to small consumer robots, this course focuses on (small) low-cost mobile robots. Therefore, a demonstration platform, the S4R rover is used to introduce students to typical challenges and applications for mobile robots. The course gives an overview of current trends and research fields for mobile robots and will focus on hand-on sessions to develop their software solutions. The student will learn to develop, implement, and test the software for the S4R rover in small student groups within the lecture and practice sessions. Individual homework assignments give students a more in-depth knowledge of relevant research topics.

1. Introduction to mobile robotics
2. Introduction to the App4MC/ S4R rover
 - * Hardware
 - * Rover API
 - * ROS (Robot Operating System) integration
3. Implementation of Navigation and Mappings tools/ methods/ algorithms
4. Application/ Use-Case definition and Implementation in small groups
5. Test and Verification
6. Presentation of Applications/ Use-Cases
7. Homework definition
8. Homework presentation

Participation requirements	programming skills (C/C++)
Examination types	<ul style="list-style-type: none"> • Presentation of Applications/ Use-Cases and Homework results in small groups + topic-related questions
Requirement for rewarding credit points	
Application of the modul (in other courses)	siehe hierzu Homepage der Ruhr Master School
Literature	<ul style="list-style-type: none"> • Robotics, Vision and Control, Peter Corke (ISBN 978-3-319-54413-7) • Probabilistic Robotics, Sebastian Thrun, Wolfram Burgard and Dieter Fox (ISBN 978-0262201629) • Embedded Robotics, Thomas Bräunl (ISBN 978-3-540-70534-5) • Jahn, U.; Wolff, C.; Schulz, P. Concepts of a Modular System Architecture for Distributed Robotic Systems. <i>Computers</i> 2019, 8, 25. • Höttger, Robert et al. "Combining Eclipse IoT Technologies for a RPI3-Rover along with Eclipse Kuksa." <i>Software Engineering</i> (2018).



Notes

- Additional (3) ECTS points can be gained by homework projects after the blockweek