Pflichtmodul weites Semester

Autonomous Systems

<table>
<tr><td>1</td><td>Module Number
3906</td><td>Study Programme
ASM</td><td>Semester
2</td><td>Offered in
WS XSS</td><td>Duration
1 Semester</td><td>Module Type
compulsory</td><td>Workload (h)
240</td><td>ECTS Points
8</td></tr>
<tr><td>2</td><td colspan="2">Courses

a) Mobile Robotics
b) Sensors
c) Data Fusion</td><td colspan="2">Teaching and Learning Forms

Lecture
Lecture
Lecture</td><td>Contact Time
(SWS)
4
2
2</td><td>(h)
60
30
30
[1 SWS = 15h]</td><td>Self-Study Time
(h)
120
[bitte nur Summe eintragen]</td><td>Language

Englisch</td></tr>
<tr><td>3</td><td colspan="9">Learning Outcomes and Competences
Once the module has been successfully completed, the students will be able to design, implement and evaluate autonomous systems, especially in the fields of mobile robotics and self-driving vehicles.

Knowledge and Understanding
The students
• understand sensor principles and sensor signal processing
• understand how to retrieve situation understanding from sensor data
• know the most important components of a mobile autonomous system, their requirements and their mode of operation

Use, Application and Generation of Knowledge

Use and Transfer
• … apply fundamental techniques and algorithms to fuse raw signals of different sensors
• … apply fundamental techniques and algorithms of a mobile robotics software system
• … analyze and develop solutions to real-world problems

Scientific Innovation
• … develop novel approaches using state of the art statistics and filtering methods
• … develop novel approaches using state of the art machine learning methods, e.g. deep neural networks

Communication und Cooperation
• ... communicate actively within a development team with engineers from other disciplines
• ... present technical contents and discuss them

Scientific Self-Conception/ Professionalism
• … design and implement software algorithms as part of a project team
• … evaluate different sensor configurations and autonomous driving system architectures</td></tr>
<tr><td>4</td><td colspan="9">Contents
Lecture: Mobile Robotics
• Introduction to mobile robotics and automated driving
• Machine learning and sensor-based environment perception
• Mapping and localization
• Action and motion planning
• Design and architecture of mobile autonomous systems

Lecture: Sensors
• Sensor Technology (Radar, Lidar, Camera)
• Sensor Raw Data
• Data Sets</td></tr>
</table>

	Data Fusion • Introduction object tracking • Basics Statistics, Kalman filter (KF) an application for automated driving • From sensor data to tracked objects, e.g. Point cloud data, segmentation and clustering
5	**Participation Requirements** compulsory: no recommended: undergraduate course in physics undergraduate course in computer science, programming in C/C++ or Python module ASM 3901 (Mathematical Methods in Engineering) module ASM 3902 (Simulation and Control)
6	**Examination Forms and Prerequisites for Awarding ECTS Points** Written Examination 120 Min
7	**Further Use of Module** Master Thesis
8	**Module Manager and Full-Time Lecturer** Prof. Dr. Ralf Schuler, Prof. Dr. Markus Enzweiler, Prof. Dr. Clemens Klöck, NN
9	**Literature** Sebastian Thrun et al.: Probabilistic Robotics. MIT Press, 2005. Richard Szeliski.: Computer Vision: Algorithms and Applications, 2022. RaJ, A. (Jun 28, 2002). Euclidean Clustering for Lidar point cloud data. RaJ, A. (Jun 6, 2002). 3D RANSAC Algorithm for Lidar PCD Segmentation. Maybeck, P.S. (1979). Chapter 1, "Introduction" from STOCHASTIC MODELS, ESTIMATION, AND CONTROL, Volume 1. Academic Press, 1979.
10	**Last Updated** 05.10.2022