Module Description, available in: EN

Autonomous mobile robot systems

General Information

Number of ECTS Credits

3

Module code

TSM_AutMobRoS

Valid for academic year

2020-21

Last modification

2019-08-31

Coordinator of the module

Björn Jensen (HSLU, bjoern.jensen@hslu.ch)

Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Lausanne			Lugano	Zurich		
Instruction					**X** E 100%		
Documentation					**X** E 100%		
Examination					**X** E 100%		

Module Category

TSM Technical scientific module

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

- Linear algebra
- General affinity to mathematics
- Basic feedback control systems
- Basic programming skills

Brief course description of module objectives and content

Mobile robots are complex mechatronic systems often interacting autonomously with their environment. The course combines theoretical foundations for coordinate transformations, sensor fusion, planning and control with examples in ROS. Tests of these complex systems can be conducted in simulated environments to speed up development and minimize risk of damage. Data from live tests can be recorded for later reuse and analysis as a foundation for further development.

Aims, content, methods

Learning objectives and acquired competencies

This course aims at giving students a deep insight into and theoretical understanding of the inner workings of autonomous mobile systems reinforced by hands-on experience of mobile robots or simulations thereof. At the end of this course students will be able to build mobile robots with autonomous behaviour.

Contents of module with emphasis on teaching content

- Mathematical foundations (short primer)
    - Coordinate transformations, quaternions
- Mobile robot platforms in different environments: air, land, sea
    - Wheeled robots, drones, submarines, …
    - Kinematics
    - Typical sensors
    - Control
    - Real-time systems
- Localization
    - Odometry
    - GPS
    - Sensor fusion
- Mapping
    - SLAM
    - Closing the loop
- Navigation
    - Planning
    - Obstacle avoidance
    - Trajectory follower
- Advanced Topics
    - Real-time systems & Robot operating system frameworks
    - Multi-robot systems
    - Modelling and simplification (Simulation & Design)
    - Dynamics of mobile robot platforms

Teaching and learning methods

Ex-cathedra teaching
Case studies
The theory learned in class is applied in exercises

Literature

Siegwart, R. et al. "Introduction to Autonomous Mobile Robots", 2011, 2nd edition, MIT Press.

ISBN 978-0262015356

Assessment

Certification requirements

Module does not use certification requirements

Basic principle for exams

As a rule, all the standard final exams for modules and also all resit exams are to be in written form

Standard final exam for a module and written resit exam

Kind of exam

written

Duration of exam

120 minutes

Permissible aids

No aids permitted

Special case: Resit exam as oral exam

Kind of exam

oral

Duration of exam

30 minutes

Permissible aids

No aids permitted