Course syllabus

Intelligent Autonomous Systems
Intelligenta autonoma system

EDAP20, 7.5 credits, A (Second Cycle)

Valid for: 2024/25
Faculty: Faculty of Engineering LTH
Decided by: PLED C/D
Date of Decision: 2024-04-16
Effective: 2024-05-08

General Information

Depth of study relative to the degree requirements: Second cycle, in-depth level of the course cannot be classified
Elective for: BME4, C4-sec, C4-pvs, D4-mai, E4, F4, M4, MMSR2, Pi4-pv
Language of instruction: The course will be given in English

Aim

To give an introduction to several subdomains of intelligent autonomous systems and robotics, and to give an orientation about fundamental methods and algorithms within these domains. To convey knowledge about breadth and depth of the domain.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- display basic knowledge concerning theory and methods related to the following subdomains:
- integration of high-level knowledge with sensing, reasoning and actuation
- robot planning on behavioural level as well as on actuation level
- robot learning and calibration
- robot vision
- robot skills
- human-robot interaction, ethical considerations
- robotic architectures for autonomous robots that supports intelligent decision making capabilities

Competences and skills
For a passing grade the student must

- complete a number of problem based assignments related to:
- demonstrating the ability to evaluate the approaches in relevant scenarios
- prepare relevant approaches
- the ability to adapt the relevant approaches in relevant scenario

Judgement and approach
For a passing grade the student must

- be able to judge suitability of a given approaches for intelligent robotics to a given problem,
- understand limitations of applicability of methods for intelligent robotics

Contents

- Three layer architecture, Perception Action Cycle, Robotic architectures, world models,
- Robot Perception: Robot vision, 3D perception, sensors, 3D pose estimation
- SLAM, Reasoning under uncertainty, MAP-Slam
- Actuation: generic problem, navigation for mobile robots, path planning for the arm, parking, autonomous car (non-holonomic constraints for complicated motion planning), drones flying, Picking + placing as two examples
- Picking: Table-top segmentation, object poses + grasping poses, Grippers
- Placing: Force-based interaction, noisy actuation, visual servoing, iTasC, compliance
- Skills, Reasoning and Planning: Skills, World knowledge, Planning

Examination details

Grading scale: TH - (U, 3, 4, 5) - (Fail, Three, Four, Five)
Assessment: To qualify for a passing grade (3) the laboratory work must be completed. With passing all assignments a student qualifies for participation in an optional exam, which gives opportunity to improve the course mark, i.e. if a 4 or 5 is achieved in the written exam, this will be the overall mark for the course.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Modules
Code: 0120. **Name:** Intelligent Autonomous Systems.
Credits: 7.5. **Grading scale:** TH - (U, 3, 4, 5). **Assessment:** To qualify for a passing grade (3) the laboratory work must be completed. With passing all assignments a student qualifies for participation in an optional exam, which gives opportunity to improve the course mark, i.e. if a 4 or 5 is achieved in the written exam, this will be the overall mark for the course. **The module includes:** Laboratory work (passing all assignments is required for passing the course). Optional written exam.

Admission

Admission requirements:

- EDAA01 Programming - Second Course **or** EDAA30 Programming in Java - Second Course **or** FRTF25 Introduction to Machine Learning, Systems and Control

The number of participants is limited to: 30
Selection: Completed university credits within the program. Priority is given to students enrolled on programmes that include the course in their curriculum.

Reading list

- Peter Corke: Robotics, Vision and Control - Fundamental Algorithms in MATLAB. Springer, 2011, ISBN: 9783319544120. reference text about Intelligent Robotics.
- Sebastian Thrun, Wolfram Burgard, Dieter Fox: Probabilistic Robotics. MIT Press, 2005, ISBN: 9780262201629. reference text on robotics under uncertainty.

Contact

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Course homepage: http://cs.lth.se/EDAP20

Further information

Detailed rules concerning the assignments will be found in the course web site.