COURSE DESCRIPTION CARD - SYLLABUS

Course name
Advanced Tools and Methods for Autonomous Robots Programming [N2AiR1-RiSA>ZNiMPRA]

Course

Field of study
Automatic Control and Robotics

Year/Semester
2/3

Area of study (specialization)
Autonomous Robots and Systems

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
20

Laboratory classes
20

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

The student starting the course should have knowledge of the basics of computer science and structured and object-oriented programming. In particular, in the field of algorithmic description of problems and the construction of data structures used in robotics. As for degree specific courses, knowledge of the basics of robotics knowledge of the basics of robotics, modern sensors in robotics as well as basic tools and methods of programming autonomous robots is required.

Course objective

The aim of the course is to expand students' knowledge of tools and software used in modern robotics with a particular focus on autonomous systems. Students will be familiarized with the advanced modules of Robot Operating System and the environment for the development of machine learning methods and testing of developed solutions

Course-related learning outcomes

Knowledge
1. has detailed knowledge of 3D data processing modules
2. has knowledge of building complex robotic systems and their debugging

3. has knowledge development environments for machine learning methods and their testing
4. has knowledge of the new generation Robot Operating System
Skills
1. has the ability to handle three-dimensional data in robotic applications
2. has the ability to build complex robotic systems and to debug them
3. has the ability to perform tasks in a development environment for machine learning methods
4. has the ability to test complex robotic systems
Social competences
1. understands the need and knows the possibilities of continuous learning
2. is ready to work in a team and understands responsibility for jointly performed tasks

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
A) In terms of verifying the assumed lecture learning outcomes is done by carrying out credit. It has the form of a test and consists of 30 questions randomly selected from the database of topics discussed during the lecture. 16 points are required to pass. The test is a single choice test and each correct answer to the question is 1 point.
B) In terms of the laboratory, the current progress during the classes will be assessed. Work during classes will be assessed by the teacher depending on the advancement of the content implemented in classes. The final grade will be a cumulative grade from all completed activities.

Programme content

The lecture program covers the following topics:
- handling of three-dimensional data and software libraries used in robotics
- state machines and high-level robotic process management
- preparation of launch scripts and software debugging
- software containerization and testing
- development environments for the development of machine learning methods
- introduction to a new generation robotic system
The laboratory program covers the following topics:
- support for Point Cloud Library (PCL) and Open3D libraries
- managing ROS nodes and using FlexBE
- roslaunch and debugging ROS nodes - transformations, data types, configuration files
- Anaconda installation environment
- running and testing software using containers - Docker
- introduction of the new generation ROS 2.0 to Robot Operating System

Teaching methods

A) Lecture: multimedia presentations (slides) illustrated with examples analyzed on the board and program code fragments implementing selected content described during the lecture
B) Laboratory: Classes will be conducted using a problem-solving approach. The student will receive an introduction to the laboratory, where the link between the topic of classes and the content of the lecture will be described. Then, with the help of the teacher, student will solve the subsequent problems that will be presented

Bibliography

Basic
Lentin Joseph, Nauka robotyki z językiem Python, Helion 2016
Robot Operating System (ROS), The Complete Reference (Volume 1, 2, 3, 4), Springer
Additional
Lentin Joseph, Jonathan Cacace, Mastering ROS for Robotics Programming - Second Edition: Design, build, and simulate complex robots using the Robot Operating System, Packt Publishing, 2018
Anil Mahtani, Luis Sanchez, Enrique Fernandez, Aaron Martinez, Effective Robotics Programming with

ROS - Third Edition, Packt Publishing, 2016
Alberto Ezquerro, Ricardo Téllez, Miguel Rodríguez, ROS 2 IN 5 DAYS: Entirely Practical Robot Operating System Training, 2019

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,00
Classes requiring direct contact with the teacher	40	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50