COURSE DESCRIPTION CARD - SYLLABUS

Course name
Autonomous cars [N2AiR1-RiSA>AS]

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
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
20

Number of credit points

3,00

Coordinators

dr inż. Krzysztof Walas
krzysztof.walas@put.poznan.pl

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 construction of data structures used in autonomous systems. As for degree specific courses the knowledge of basics of robotics, modern sensors in robotics as well as basic tools and methods of programming autonomous robots is required. In addition, knowledge of vision systems, machine learning, and motion planning methods and algorithms will be useful.

Course objective

The aim of the course is to familiarize students with issues related to autonomous vehicles. Particular emphasis will be placed on the aspects of system integration and it will be indicated how the issues related to robotics, sensor technology, vision systems, machine learning and traffic planning are combined in autonomous vehicles.

Course-related learning outcomes

Knowledge
1. has detailed knowledge of autonomous car systems

2. has knowledge on the use of vision systems and machine learning methods in autonomous vehicles
3. has knowledge of the integration of systems in autonomous vehicles and the use of simulation tools in the development and testing of implemented solutions
4. has knowledge of control and motion planning for autonomous cars
Skills
1. has the ability to analyze systems in autonomous vehicles
2. has the ability to build control algorithms and traffic planning for autonomous cars with the use of simulation and real systems
3. has the ability to integrate data from sensors located in autonomous vehicles and process them using machine learning methods
4. has the ability to locate autonomous cars and build a map of their surroundings
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
3. is aware of the importance and understands the non-technical aspects and effects of engineering activities, including its impact on the environment and the associated responsibility for decisions

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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A) In the scope of lectures, the assumed learning outcomes are verified by conducting an oral exam. The questions are drawn from the database of questions created from the topics introduced during the lecture. Each student receives 2 questions on the basis of which the material acquired is assessed. The questions are assessed jointly and depending on the completeness of the answer given to each of them, a final grade is given.
B) In terms of the project, the group of students prepare a project. The evaluation is determined on the basis of the current progress in the project, the introduction of each subsequent functionality designated for a given project results in obtaining a higher grade.

Programme content

- introduction to autonomous vehicles
- sensors in autonomous vehicles
- data fusion from sensors provided by autonomous vehicles
- computer vision in terms of vehicle autonomy
- architectures of deep neural networks used in the development of autonomous vehicles
- simulation systems supporting the development and testing of autonomous cars
- localization and maping in local and global terms
- motion planning from the perspective of autonomous vehicles
- autonomous car control algorithms
- communication systems for autonomous cars - on-board and between vehicles
- system integration and safety of autonomous cars

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) Project: overview of project tasks and requirements on the progress of the project for each of the grades. The project is executed as a code development task. Weekly project consultations, during which students receive the tutor's support allowing them to continue work on the project and the progress of work is assessed.

Bibliography

Basic
Lentin Joseph, ROS Robotics Projects, Packt Publishing, 2017
Markus Maurer, J. Christian Gerdes, Barbara Lenz, Hermann Winner,Autonomous Driving – Technical,

Legal and Social Aspects, Springer,Berlin, Heidelberg, 2016
Additional
Marc P. Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Mathematicsfor Machine Learning, Cambridge University Press, 2020

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