AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Service robots

Academic year: 2013/2014 Code: RMS-1-505-s ECTS credits: 12

Faculty of: Mechanical Engineering and Robotics

Field of study: Mechatronics with English as instruction languagege Specialty: —

Study level: First-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 5

Course homepage: —

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Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence			
M_K001	awareness of the responsibility for own work and readiness to comply with the rules of team work and accepting responsibility for tasks performed collectively	MS1A_K04	
Skills			
M_U001	ability to work individually or in team, to estimate the time needed to complete an assigned task; able to develop and complete a schedule of works and meet the deadlines	MS1A_U02	
M_U002	ability to develop documentation related to the completion of an engineering task and prepare text discussing the results of the task	MS1A_U03	
M_U003	ability to use methods and mathematical models and computer simulations to analyse and assess the operation of mechatronic equipment and systems	MS1A_U07	

M_U004	ability to formulate an algorithm; to use high-level programming languages and proper IT tools to develop programs and software for microcontrollers and microprocessors used in a mechatronic system	MS1A_U14	
M_U005	ability to evaluate the usefulness of routine methods and tools for solving simple engineering tasks typical for mechatronics and select and apply proper methods and tools	MS1A_U20	
M_U009	competence in independent study, also to improve professional qualifications	MS1A_U06	
Knowledge			
M_W001	elementary knowledge of electronics and electrical engineering	MS1A_W04	
M_W002	basic knowledge of robotics	MS1A_W05	
M_W003	basic knowledge of actuators and sensors, including vision systems used in mechatronic systems and devices	MS1A_W06	
M_W004	basic knowledge of metrology, knowledge and understanding of the methods of measuring basic physical quantities, knowledge of computational methods and IT tools necessary to analyse experiment results	MS1A_W07	
M_W005	well-ordered and theory-based knowledge of technical mechanics necessary for formulating and solving problems in mechatronics	MS1A_W08	
M_W006	well-ordered knowledge of microprocessor systems, basics of IT science, programming methods and techniques	MS1A_W10	
M_W007	well-ordered and theory-based knowledge of the construction of precise machinery, including the theory of machines and mechanisms necessary for formulating and solving problems in mechatronics	MS1A_W11	
M_W008	knowledge and understanding of the methodology of designing mechatronic devices and methods and techniques used for the design, including the artificial intelligence method; knowledge of computer tools for the design and simulation of mechatronic devices	MS1A_W12	

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Others	Fieldwork classes	Workshops	E-learning
Social competence												

M_K001	awareness of the responsibility for own work and readiness to comply with the rules of team work and accepting responsibility for tasks performed collectively	-	-	+	+	-	-	-	-	-	-	-
Skills												
M_U001	ability to work individually or in team, to estimate the time needed to complete an assigned task; able to develop and complete a schedule of works and meet the deadlines	-	-	+	+	-	-	-	-	-	-	-
M_U002	ability to develop documentation related to the completion of an engineering task and prepare text discussing the results of the task	-	-	-	+	-	-	-	-	-	-	-
M_U003	ability to use methods and mathematical models and computer simulations to analyse and assess the operation of mechatronic equipment and systems	-	-	+	+	-	-	-	-	-	-	-
M_U004	ability to formulate an algorithm; to use high-level programming languages and proper IT tools to develop programs and software for microcontrollers and microprocessors used in a mechatronic system	-	-	+	+	-	-	-	-	-	-	-
M_U005	ability to evaluate the usefulness of routine methods and tools for solving simple engineering tasks typical for mechatronics and select and apply proper methods and tools	-	-	+	+	-	-	-	-	-	-	-
M_U009	competence in independent study, also to improve professional qualifications	-	-	+	-	-	-	-	-	-	-	-
Knowledge												
M_W001	elementary knowledge of electronics and electrical engineering	+	-	-	-	-	-	-	-	-	-	-
M_W002	basic knowledge of robotics	+	-	-	-	-	-	-	-	-	-	-
M_W003	basic knowledge of actuators and sensors, including vision systems used in mechatronic systems and devices	+	-	-	-	-	-	-	-	-	-	-

M_W004	basic knowledge of metrology, knowledge and understanding of the methods of measuring basic physical quantities, knowledge of computational methods and IT tools necessary to analyse experiment results	+	-	-	-	-	-	-	-	-	-	-
M_W005	well-ordered and theory-based knowledge of technical mechanics necessary for formulating and solving problems in mechatronics	+	-	-	-	-	-	-	-	-	-	-
M_W006	well-ordered knowledge of microprocessor systems, basics of IT science, programming methods and techniques	+	-	-	-	-	-	-	-	-	-	-
M_W007	well-ordered and theory-based knowledge of the construction of precise machinery, including the theory of machines and mechanisms necessary for formulating and solving problems in mechatronics	+	-	-	+	-	-	-	-	-	-	-
M_W008	knowledge and understanding of the methodology of designing mechatronic devices and methods and techniques used for the design, including the artificial intelligence method; knowledge of computer tools for the design and simulation of mechatronic devices	+	-	-	+	-	-	-	-	-	-	-

Module content

Lectures

Getting to know the state of the art and the description of a mathematical model of service robots

Lectures present the current state of knowledge on the construction, use and operating conditions of service robots in particular mobile robots. As part of the classes is presented mathematical description of mobile service robots. Extensively analysed issues related to the forward and inverse kinematics and dynamics. The lectures are related control and construction description of various types of service robots and manipulation robots. Motion analysis for walking robots. Grippers and end-effectors in robotics. Manipulation Robots. Manipulation Robots in medicine.

Laboratory classes

Implementation of the mathematical model of mobile service robots

As part of the classes is required implementation of mathematical models and the identification of service robots dynamic equations of motion in the MATLAB environment. Computational analysis in MATLAB environment concerns issues related to kinematics, dynamics and identification of dynamic equations of motion with the

use of artificial intelligence algorithms based on fuzzy logic. The laboratories are also analysed issues related to the control and construction of various types of service robots. Robots in medicine.

Project classes

Creating a mathematical model of mobile service robots
During the project classes is required to develop mathematical models of service robots and identification of dynamic equations of motion. Extensively analysed issues related to the kinematics, dynamics and the identification of dynamic equations of motion with the use of artificial intelligence algorithms based on fuzzy logic. The exercises are also analysed issues related to the control and construction of various types of service robots. Analysis of the motion for walking robots. Description of the walking robots.

Method of calculating the final grade
Average marks of the project and the laboratory

Prerequisites and additional requirements
Knowledge of matrix, differential, basic knowledge of mechanics, strength of materials, machine design basics and control theory.

Recommended literature and teaching resources
Jones J. L., Seiger B. A., Flynn A. M., Mobile Robots: Inspiration to Implementation, Second Edition, 1998.
Siegwart R., Nourbakhsh I. R., Scaramuzza D., Introduction to Autonomous Mobile Robots (Intelligent Robotics and Autonomous Agents series),2011.
Cook G., Mobile Robots: Navigation, Control and Remote Sensing, 2011.

Scientific publications of module course instructors related to the topic of the module
Additional scientific publications not specified

Additional information
None

Student workload (ECTS credits balance)

Student activity form	Student workload
Examination or Final test	2 h
Participation in lectures	60 h
Participation in project classes	45 h
Participation in laboratory classes	45 h
Realization of independently performed tasks	85 h
Preparation for classes	45 h
Completion of a project	45 h
Summary student workload	327 h
Module ECTS credits	12 ECTS