SYLLABUS OF A MODULE

Polish name of a module	**Systemy autonomiczne**
English name of a module	**Autonomous Systems**
ISCED classification - Code	0613
ISCED classification - Field of study	*Software and applications development and analysis*
Languages of instruction	*English*
Level of qualification:	*2 - MSc (EQF 7)*
Number of ECTS credit points	*4*
Examination:	*A-assignment*
Available in semester:	*Y – both semesters*

Number of hours per semester:

Lecture	Exercises	Laboratory	Seminar	E-learning	Project
15		45			

MODULE DESCRIPTION

MODULE OBJECTIVES

O1. To familiarize students with autonomous, agent, and multi-agent systems as well as their equipment.

O2. Acquiring practical skills in data processing collected from sensors.

O3. Acquiring practical skills in the field of analysis, construction, and creation of autonomous systems.

PRELIMINARY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of the basics of programming.
2. Basic knowledge of how neural networks work.
3. Basic knowledge of electronics/embedded systems.

4. Ability to search and select information, including instructions and technical documentation.
5. Correct interpretation and presentation of the student's own activities.

LEARNING OUTCOMES

LO 1 – The student knows the methods of intelligent control of robots and autonomous systems.

LO 2 – The student can design and model intelligent IT systems, considering the principles of collective creation of cooperating system elements.

LO 3 – The student is competent in working independently and in a team, conducting scientific research, and drawing conclusions from conducted exercises.

MODULE CONTENT

Type of classes – lecture	**Number of hours**
Lec 1 - Types of sensors: cameras, thermographic cameras, dynamic vision sensors (event camera), LIDAR, LIDAR 3D, IMU	**1**
Lec 2 - Raw data processing, types of data conditioning filters	**1**
Lec 3 - Data transmission interfaces between microprocessors, automotive data communication buses (especially CAN (FD))	**1**
Lec 4 - Introduction to ROS (Robot Operating System)	**1**
Lec 5 - Mobile robots	**1**
Lec 6 - Types of ML algorithms, deep and convolutional neural networks, impulse neural networks	**1**
Lec 7 - Python ML frameworks	**1**
Lec 8 - Interpretation and understanding of images	**1**
Lec 9 - Intelligent autonomous systems	**1**
Lec 10 - Programing of autonomous systems	**1**
Lec 11- Edge AI concept. Edge AI platforms, e.g. CPU (RPI), GPGPU (CUDA, NVidia Jetson), ANN coprocessors (Google Coral), neuromorphic circuits	**1**

Lec 12 - Agent platforms and tools, examples of applications	**1**
Lec 13 - Architecture of agent and multi-agent systems (MAS)	**1**
Lec 14 - Typical control structures and multi-agent systems	**1**
Lec 15 - Passing the lectures	**1**
Sum	**15**
Type of classes– laboratory.	**Number of hours**
Lab 1 - Examination of various types of sensor data	**3**
Lab 2-3 - Raw data processing (IMU, temperature, humidity, LIDAR)	**6**
Lab 4 - Data transmission between microprocessors using communication bus/interface	**3**
Lab 5 - Introduction to ROS	**3**
Lab 6 - Sensors testing using ROS	**3**
Lab 7 - Introduction to Python programming	**3**
Lab 8-9 - Use of Python frameworks for selected ML issues, deep and convolutional neural networks, impulse neural networks	**6**
Lab 10 - Interpretation of images using Python frameworks	**3**
Lab 11 - 13 - Development of a simple autonomous platform	**9**
Lab 14 - Application of agent or multi-agent systems in the developed platform	**3**
Lab 15 - Autonomous platform tests, course credit	**3**
Sum	**45**

TEACHING TOOLS

1. Lecture with multimedia presentation
2. Preparation of reports on completed laboratory exercises
3. Instructions for laboratory exercises
4. Laboratory equipped with PC, microcontrollers, sensors

WAYS OF ASSESSMENT (F – FORMATIVE, S – SUMMATIVE

F1. – Assessment of preparation for laboratory exercises
F2. – Assessment of the ability to apply the acquired knowledge during the exercises
F3. – Assessment of reports on the implementation of exercises included in the course guide
F4. – Evaluation of activity during classes
P1. – Assessment of the ability to solve the problems posed and the method of presenting the obtained results in the form of reports – credit with a grade*
P2. – Assessment of the mastery of the teaching material being the subject of the lecture – lecture test (or exam)

*) the condition for obtaining credit is to obtain positive grades from all laboratory exercises and to complete the test task.

STUDENT'S WORKLOAD

L.p.	**Forms of activity**	**Average number of hours required for realization of activity**
1. Contact hours with teacher		
1.1	Lectures	15
1.2	Tutorials	0
1.3	Laboratory	45
1.4	Seminar	0
1.5	Project	0
1.6	Examination	0
	Total number of contact hours with teacher:	60
2. Student's individual work		
2.1	Preparation for tutorials and tests	10
2.2	Preparation for laboratory exercises, writing reports on laboratories	10
2.3	Preparation of project	0
2.4	Preparation for final lecture assessment	10
2.5	Preparation for examination	0

2.6	Individual study of literature	10
	Total number of hours of student's individual work:	40
	Overall student's workload:	100
Overall number of ECTS credits for the module		4 ECTS
Number of ECTS points that student receives in classes requiring teacher's supervision:		2,4 ECTS
Number of ECTS credits acquired during practical classes including laboratory exercises and projects:		2,2 ECTS

BASIC AND SUPPLEMENTARY RESOURCE MATERIALS

1. Hughes C., Hughes T.:" Robot Programming: A Guide to Controlling Autonomous Robots", Que Publishing; 1 edition (May 22, 2016)
2. Lutz M.; 'Programming Python. Powerful Object-Oriented Programming. 4th Edition', O'Reilly Media
3. De Gyurky M., Tarbell M.A.: "The Autonomous System: A Foundational Synthesis of the Sciences of the Mind", Wiley

MODULE COORDINATOR (NAME, SURNAME, E-MAIL ADDRESS)

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