



### COURSE DESCRIPTION

Course code	full-time studies	
	part-time-studies	
Course name	<b>Systemy lokalizacji obiektów w czasie rzeczywistym</b>	
Course name in English	<b>Real time location systems</b>	
Valid from academic year	<b>2022/23</b>	

### PLACEMENT IN THE TEACHING PROGRAM

Field of study	<b>Computer Science</b>
Level of education	<b>1<sup>st</sup> degree</b>
Studies profile	<b>General</b>
Form and method of teaching classes	<b>Full-time and part-time studies</b>
Specialization	<b>Information and communication technology</b>
Organizational unit responsible for the course	<b>Katedra Systemów Informatycznych</b>
Course coordinator	<b>dr inż. Mirosław Płaza</b>
Approved by	<b>Dean of the Faculty of Electrical Engineering, Automatic Control and Computer Science Roman Deniziak, KUT prof., DSc, PhD</b>

### GENERAL CHARACTERISTIC OF THE COURSE

Course affiliation	<b>Speciality</b>	
Course status	<b>not obligatory</b>	
Language	<b>English</b>	
Semester	full-time studies	<b>Semester VI</b>
	part-time-studies	<b>Semester VII</b>
Requirements	<b>Computer networks</b>	
Exam (YES/NO)	<b>NO</b>	
ECTS	<b>4</b>	

Course form		lecture	classes	laboratory	project	other
Hours per semester	full-time studies	<b>30</b>		<b>30</b>		
	part-time-studies	<b>18</b>		<b>18</b>		

## LEARNING RESULTS

Category	Result Symbol	Learning Results	References to the field of study results
Knowledge	W01	Students know and understand methods of identifying objects and people and methods of determining their location in 2D and 3D space.	INF1_W30
	W02	Students know and understand wireless technologies used in real-time object location systems.	INF1_W30
	W03	Students know and understand industrial object location systems and example software interfaces of RTLS systems.	INF1_W30
Skills	U01	Students are able to solve typical tasks related to object localization in RTLS systems and correctly interpret the obtained results.	INF1_U30
	U02	Students are able to implement various wireless technologies in RTLS systems.	INF1_U30
	U03	Students are able to evaluate the performance of real-time object location systems	INF1_U30
Social competence	K01	Students are prepared to evaluate the importance of real-time object location systems and their impact on social aspects.	INF1_K1 INF1_K2
	K02	Students are prepared to work in a group in the scope of real-time object location systems.	INF1_K1 INF1_K2

## COURSE CONTENT

Course Form	Content
lecture	<ol style="list-style-type: none"> <li><b>Introduction to real-time object localization systems</b> (definitions, examples of solutions for object and people localization).</li> <li>2D and 3D object identification and localization.</li> <li><b>Object location methods</b> (relative, absolute, tags including: radio, optical, acoustic, ultrasonic used in RTLS systems).</li> <li><b>Characteristics of RTLS solutions</b> (RTLS systems built based on: WiFi, IR, BLE; technologies: RFID, ZigBee)</li> <li><b>Beacon technology</b> (introduction, characteristics of different types of beacons and their commercial applications).</li> <li><b>Manufacturing systems</b> (real-time localization in smart manufacturing systems).</li> <li><b>Software interfaces</b> (example software interfaces in selected industrial real-time object localization systems).</li> <li><b>Applications</b> (applications of RTLS systems in various business areas).</li> </ol>
laboratory	<ol style="list-style-type: none"> <li>Exploration of RTLS systems based on microprogrammable platforms.</li> <li>Selected methods of approximation of measurement data.</li> <li>Determination of location using mobile devices.</li> <li>Exploration of software dedicated to beacon technology.</li> <li>Determination of location using various types of beacons.</li> <li>Exploration of RTLS systems based on Wi-Fi, IR, BLE technology</li> </ol>

## LEARNING RESULTS VERIFICATION METHODS

Result Symbol	Learning results verification methods					
	Oral Exam	Written Exam	Midterm	Project	Report	Other
W01			X			
W02			X			
W03			X			
U01			X			
U02			X			
U03			X			
K01			X			
K02			X			

## ASSESSMENT FORMS AND CRITERIA

Course Form	Assessment Form	Assessment Criteria
lecture	pass with a grade	Obtaining at least 50% of the points from the pass tests during the laboratory classes.
laboratory	pass with a grade	Obtaining at least 50% of the points from the pass tests during the laboratory classes.

## STUDENT'S VOLUME OF WORK

ECTS Balance												
No.	Activity Type	Student Involvement										Unit
		full-time studies					part-time-studies					
		Lec	C	Lab	P	S	Lec	C	Lab	P	S	
1.	Participation in classes according to the schedule	30		30			18		18			h
2.	Other (consultations, exams)	2		2			2		2			h
3.	<b>Total with the direct assist of an academic teacher</b>	<b>64</b>					<b>40</b>					h
4.	<b>Number of ECTS, that students obtains with the direct assist of an academic teacher</b>	<b>2,56</b>					<b>1,60</b>					ECTS
5.	<b>Hours of unassisted student work</b>	<b>36</b>					<b>60</b>					h
6.	<b>Number of ECTS that student obtains working unassisted</b>	<b>1,44</b>					<b>2,40</b>					ECTS
7.	<b>Practical classes volume of work</b>	<b>30</b>					<b>18</b>					h
8.	<b>Number of ECTS obtained by student at practical classes</b>	<b>1,2</b>					<b>0,72</b>					ECTS
9.	<b>Total student's volume of work expressed in hours</b>	<b>100</b>					<b>100</b>					h
10.	<b>ECTS</b>	<b>4</b>										

## **BIBLIOGRAPHY**

1. Ajay Malik, **RTLS For Dummies**, 2009
2. Gordon Colbach, **RFID Handbook: Technology, Applications, Security and Privacy**, 2018
3. Statler Stephen, **Beacon Technologies: The Hitchhiker's Guide to the Beacosystem**, 2016
4. Cisco, **Cisco DNA Spaces Configuration Guide**, 2022