GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mobile Robots, PG_00062384		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	4	Language of instruction	Polish
Semester of study	7	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Biomechatronics -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Mariusz Dąbkowski	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	15.0	0.0	45

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	45	3.0	52.0	100

Subject objectives

The aim of the course is to familiarize students with issues concerning: structure of mobile robots, types of mobility, map building, localization of robots, basic navigation methods in the known and unknown environment, structure of robot control system, complete area coverage problem.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U05] can use analytical and simulation methods to solve tasks in the field of automation and robotics and use various techniques to carry out engineering tasks related to automation and robotics devices and systems	Student is able to plan experiments to verify the accuracy of measurement of reflective sensors (sonar, infrared sensor).	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
[K6_K02] can work in a group taking on different roles in it	Student is able to cooperate in a laboratory group during robot programming exercises. Is able to independently solve the assigned design task in the field of robot construction and cooperate to integrate achievements in the group.	[SK4] Assessment of communication skills, including language correctness [SK3] Assessment of ability to organize work [SK2] Assessment of progress of work [SK1] Assessment of group work skills
[K6_W10] has basic knowledge related to mechatronics and robotics systems	Student can design and build mobile robots to perform selected tasks and program them.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation

Subject contents

LECTURE: The types of mobility robot (wheels, track, rolling mechanisms, etc.) - a review. The process of collecting data about the environment and the problem of mobile robot control. Overview of sensors used in mobile robots: sonar, infrared sensor, active vision systems - structure, precision, limits, rules of selection, bumpers, odometry encoders. Methods of construction and renovation of the environment on the basis of map data. Formulation of the problem of planning collision-free trajectories. Fundamentals of behavioral control methods: reactive and pseudoreactive behaviors. A subsumption architecture of mobile robot control system. Hexapod robot - Hexor - structure and ways of programming. Two-wheeled mobile robot Scorpion - design and programming. Two-wheeled robot Pioneer 3DX - design and programming.
LABORATORY: A set of exercises that illustrate issues discussed during the lecture.

Prerequisites and co-requisites

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td></td><td>50.0%</td><td>50.0%</td></tr>
<tr><td></td><td>100.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. Dulęba I.: Metody i algorytmy planowania ruchu robotów mobilnych i manipulacyjnych. Warszawa: Akademicka Oficyna Wydawnicza EXIT 2001.
2. Giergiel M. J., Hendzel Z., Żylski W.: Modelowanie i sterowanie mobilnych robotów kołowych. Warszawa: Wydawnictwa Naukowe PWN 2002.
3. Woźniak A.: Autonomiczne roboty mobilne laboratorium. Poznań: Wydawnictwo Politechniki Poznańskiej 1994.
4. Prochowski L.: Mechanika ruchu. WKiŁ, Warszawa, 2005.
5. Kozłowski K., Dutkiewicz P., Wróblewski W.: Modelowanie i sterowanie robotów. Warszawa: Wydawnictwo Naukowe PWN 2003.</td></tr>
<tr><td>Supplementary literature</td><td>1. Borenstein J., Everett H. R., Feng L.: Where am I? sensors and methods for mobile robot positioning. The University of Michigan. 1996.
2. R. C. Arkin: Behavior-Based Robotics. MIT. 1998.
3. Acar E. U., Choset H. Rizzi A. A., Atkar P. N., Hull D.: Morse decompositions for coverage tasks. Sage Publications 2002. The International Journal of Robotics Reaserch. Vol. 21.
4. Choset. H., Burdick J.: Sensor based motion planning: Incremental construction of the hierarchical generalized voronoi graph. 2000. International Journal of Robotics Research. 19. Vol. 2 pp. 126-148.
5. Choset H., Pignon P.: Coverage path planning: the boustrophedon cellular decomposition. In: Proceedings of the International Conference on Field and Service Robotics. 1997.
6. MacKenzie D. C., Balch T. R.: Making a clean sweep behavior based vacuuming. In Proceedings of the AAAI Fall Symposium, Instationating Real-World Agents.1996.
7. Mann G., Katz G.: Chemical trail guidance for floor cleaning machines. In: Proceedings. of the 2nd International Conference on Field & Service Robotics. 1999.
8. Massa D. P.: Choosing an ultrasonic sensor for proximity or distance measurement, part 1 & 2.
9. Neumann de Carvalho R., Vidal H. A., Vieira P., Ribeiro. M.I.: Complete coverage path planning and guidance for cleaning robots. Proceedings of the In Proceedings of the IEEE International Symposium on Industrial Electronics. 1997.</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">• Types of robot mobility (wheels, tracks, legs, etc.) - a review.
• The process of collecting data about the environment versus mobile robot control.
• Review of sensors used in mobile robots: sonar, infrared sensor, vision systems - design, accuracy, limitations, principles of selection; bumpers, encoders.
• Methods of construction and updating environment maps using sensory data.
• The definition of collision-free path planning.
• Basic methods of behavioral control: reactive and proactive behaviors.
• The subsumption architecture versus deliberative architecture of control system for mobile robots.</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
</table>

Document generated electronically. Does not require a seal or signature.