GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Telematics of transportation systems, PG_00064991						
Field of study	Telematyka w transporcie						
Date of commencement of studies	February 2025			Academic year of realisation of subject		2025/2026	
Education level	second-cycle studies			Subject group		Specialty subject group Subject group related to scientific research in the field of study	
Mode of study	Full-time studies			Mode of delivery		at the university	
Year of study	1			Language of instruction		Polish	
Semester of study	2			ECTS credits		3.0	
Learning profile	general academic profile			Assessment form		assessment	
Conducting unit	Division of Applied Computer Science -> Institute of Naval Architecture -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor			dr inż. Tacjana Niksa-Rynkiewicz			
	Teachers			dr inż. Tacjana Niksa-Rynkiewicz			
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	30.0	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		4.0	26.0		75
Subject objectives	The aim of the course is to introduce students to advanced topics in telematics within the context of modern transport and logistics systems. Students will gain knowledge about the integration of information, communication, and sensor technologies in the design of intelligent systems. As part of the project work, students will carry out experiments related to Human Activity Recognition (HAR) using sensor data and simple feedforward neural network (FFN) models. The project is designed to develop practical skills in applying AI algorithms to telematics data analysis and interpreting the results in terms of system efficiency and safety in transport and logistics.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W03] demonstrates structured and theory supported knowledge encompassing key issues in the field of Transport and Logistics, enabling developement and synthesis of transport systems and processes	The student demonstrates structured theoretical knowledge in telematics and its applications in Transport and Logistics, enabling the design and synthesis of intelligent systems for monitoring, analysis, and decision support in transport processes.	[SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym
	[K7_W12] identifies and interprets the main developmental trends and significant new achievements in the field of engineering and technical sciences and disciplines relevant to the course of study	The student identifies and interprets current development directions in telematics and selected achievements in data engineering and artificial intelligence applicable to modern transport and logistics systems, with particular focus on sensor data-based solutions.	[SW2] Ocena wiedzy zawartej w prezentacji [SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym
	[K7_W11] interprets social, economic, legal (including industrial and intellectual property laws), and other non-technical aspects of engineering activities, and includes them into engineering practice	The student interprets social, legal, and ethical aspects of applying telematics systems and AI-based solutions, including data protection, intellectual property rights, and the impact of technology on safety and user well-being in transport systems.	[SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym
	[K7_W01] explains and describes, based on general knowledge in the field of scientific disciplines forming the theoretical foundations of Transport and Logistics, the construction and principles of operation of transport systems, processes and their components, as well as methods and means of their integration	The student explains and describes the structure and functioning of integrated transport systems, with particular emphasis on the role of telematics and the use of modern data analysis methods (including artificial intelligence) in monitoring and optimizing logistics processes.	[SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym

Subject contents	Course content – lecture **Lectures:** 1. Introduction to telematics definitions, application areas, and its role in transport and logistics. 2. Architecture and components of telematic systems (sensors, communication networks, processing units, interfaces). 3. Communication in telematic systems data transmission standards, technologies, IoT. 4. Sensor data integration structure, data quality, preprocessing methods. 5. Fundamentals of data analysis and decision support methods in transport systems. 6. Introduction to artificial intelligence in telematics: classification methods, neural networks, fuzzy logic. 7. Feedforward Neural Networks (FFN) principles, architecture, training process. 8. Overview of Human Activity Recognition (HAR) applications in operational monitoring and safety. 9. Ethical and legal considerations: data protection, privacy, intellectual property. 10. Challenges and development trends in telematics and intelligent transport systems. **Project / Practical work:** 1. Analysis of real-world sensor data from a human activity monitoring system (HAR). 2. Building and training a simple FFN model for recognizing transport/logistics-related activities. 3. Model validation and interpretation of the confusion matrix. 4. Discussion of potential applications of HAR systems in ergonomics, workplace safety, and process monitoring. 5. Preparation of a project report and presentation of results.
Prerequisites and co-requisites	
Assessment methods and criteria	see table below

Subject passing criteria	Passing threshold	Percentage of the final grade
project	60.0%	90.0%
activity	80.0%	10.0%

<table>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. Zagadnienia ogólne i przeglądowe z HAR (teoria + przegląd metod):

•
Bulling, A., Blanke, U., Schiele, B. (2014). A tutorial on human activity recognition using body-worn inertial sensors. ACM Computing Surveys, 46(3), Article 33.
Bardzo dobre wprowadzenie teoretyczne do HAR, powszechnie cytowane.

•
Wang, J., Chen, Y., Hao, S., Peng, X., Hu, L. (2019). Deep learning for sensor-based activity recognition: A survey. Pattern Recognition Letters, 119, 311.
Systematyczny przegląd metod głębokiego uczenia w HAR.

•
Dua, N. et al. (2022). A Survey on Human Activity Recognition Using Deep Learning Techniques and Wearable Sensor Data.
Nowoczesne podsumowanie metod i wyzwań w HAR z czujników ubieralnych.

2. Zastosowania FFN w HAR i klasyfikacji:

•
Jahagirdar, A., Phalnikar, R. (2022). Comparison of feed forward and cascade forward neural networks for human action recognition. IJEEC, 25(2), 892-899.
Bezpośrednie porównanie FFN w kontekście HAR.

•
Dhanaseely, J., Himavathi, S., Srinivasan, E. (2012). Performance comparison of cascade and feedforward neural networks for face recognition.
Można wykorzystać do pokazania różnic między strukturami FFN.

•
Arulampalam, G., Bouzerdoum, A. (2003). A generalized feedforward neural network architecture for classification and regression. Neural Networks, 16(56), 561568.
Podstawy teoretyczne dla FFN w zastosowaniach klasyfikacyjnych.</td></tr>
<tr><td>Supplementary literature</td><td>3. Praktyczne zastosowania w środowiskach przemysłowych:

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Mastakouris A. et al. (2023). Human worker activity recognition in a production floor environment through deep learning. Journal of Manufacturing Systems, 71, 115130.
Świetne odniesienie do środowisk produkcyjnych i realnych aplikacji HAR.

•
Angelidis A. et al. (2025). An open extended reality platform supporting dynamic robot paths for studying humanrobot collaboration. IJAMT, 138, 315.
Nowoczesne podejście do współpracy człowieka z robotem wpisuje się w kontekst telematyki i ergonomii.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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Example issues/ example questions/ tasks being completed	**Sample topics / questions / tasks:** • What are the key components of a telematics system in transport? • How can sensor data be preprocessed and used to support decision-making in logistics? • What is the architecture and training procedure of a Feedforward Neural Network (FFN)? • How can HAR (Human Activity Recognition) be applied in transport and logistics? • Identify potential applications of AI in smart transport systems. • What are the main ethical and legal concerns in deploying telematics solutions (e.g., data privacy, ownership)? • Compare different sensor modalities and their relevance in real-time monitoring. • Train a simple FFN model to classify human activities based on smartphone sensor data. • Validate a classification model and interpret its confusion matrix. • Design a concept of a telematics-based decision support system for logistics operations.
Practical activites within the subject	Not applicable