GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Photogrammetry and remote sensing in energy sector, PG_00055986		
Field of study	Power Engineering, Power Engineering, Power Engineering		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2026/2027
Education level	first-cycle studies	Subject group	Optional 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	4	Language of instruction	Polish The project is based on public data or materials provided by the instructor. The course does not require specialised equipment or UAV flights. The detailed project topic may be adjusted to data availability and students' interests.
Semester of study	7	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Geodesy -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Jakub Szulwic	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	15.0	0.0	30

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	30	2.0	18.0	50

Subject objectives

To introduce students to the possibilities and limitations of using photogrammetry, remote sensing and spatial data for the documentation, inventory and monitoring of energy infrastructure and its surroundings. The course develops the ability to select appropriate data sources, interpret imagery and spatial models, and prepare a basic study supporting the analysis of a selected engineering problem, with consideration given to data accuracy, currency and limitations.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W16] has an elementary knowledge about energy and environmental construction including building materials, their strength, construction mechanics and building physics, moisture migration in buildings, heat transfer through building partitions, has a basic knowledge of marine and inland hydrotechnical structures; has knowledge of the hydraulic and hydrological conditions of designing facilities and building structures, photogrammetry, remote sensing, hydrography, and spatial analysis.	The student knows the basic sources of photogrammetric and remote sensing data and products, in particular orthophotomaps, satellite imagery, point clouds, elevation models and 3D models. The student understands their possibilities and limitations in the inventory, monitoring and spatial analysis of energy infrastructure and its surroundings.	[SW1] Assessment of factual knowledge
[K6_U12] can correctly choose tools (analytical or numerical) to solve engineering problems filtration processes, and data analysis; is able to use photogrammetric and remote sensing tools in engineering tasks in the field of geodetic techniques and metrology	The student is able to select available photogrammetric, remote sensing and spatial data for a chosen problem related to energy infrastructure, perform their basic processing, analysis and visualisation, and assess the usefulness of the results with regard to data resolution, accuracy, currency and completeness.	[SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task

Subject contents

Course content – lecture

The role of photogrammetry, remote sensing and spatial information in supporting engineering tasks in the energy sector. Data sources: terrestrial, airborne, UAV and satellite imagery, orthophotomaps, point clouds and elevation data. Fundamentals of image geometry and photogrammetric measurement. Spatial, temporal, spectral and radiometric resolution, as well as data accuracy, currency, completeness and uncertainty. Photogrammetric products: orthophotomaps, point clouds, terrain models, surface models and 3D models. Fundamentals of multi-image photogrammetry, automatic image matching and Structure from Motion. Multispectral and thermal imagery - possibilities and limitations. Applications in the inventory and monitoring of buildings, photovoltaic installations, wind farms, transmission lines, pipelines, hydraulic structures and their surroundings. Land-cover change analysis and preliminary assessment of spatial conditions for energy investments. Integration with GIS and technical documentation. Automated image interpretation, the use of AI and critical evaluation of results. Basic legal, organisational, ethical and safety aspects. Examples of research and applications in the energy sector and environmental monitoring.

Course content – project

The project is based on public data, datasets provided by the instructor or, subject to prior agreement, images acquired by students. The student defines the problem and purpose of the study, selects photogrammetric, remote sensing or spatial data, assesses their source, resolution, currency, completeness and limitations, and performs basic processing, measurement, analysis or 2D/3D visualisation. The results are interpreted in the context of a selected energy-related problem, with the limitations of the method clearly identified, and presented as a map, model, summary, short report and presentation. Example tasks include a preliminary analysis of roofs for photovoltaic installations; analysis of changes near a power line, pipeline, power plant, wind farm or photovoltaic farm; preparation of a 3D model of a technical object; comparison of public data sources; and interpretation of provided thermal or multispectral imagery.

Prerequisites and co-requisites

Basic digital literacy and the ability to interpret maps, technical drawings, and numerical data, acquired during earlier stages of study. No prior knowledge of photogrammetry, remote sensing, GIS, or specialized geoinformatics software is required.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written test	60.0%	30.0%
Project with report and presentation	60.0%	70.0%

Recommended reading	Basic literature	1. Pyka K., Podstawy fotogrametrii [Basics of Photogrammetry], Akademia Górniczo-Hutnicza im. Stanisława Staszica, Kraków 2024. 2. Kurczyński Z., Fotogrametria [Photogrammetry], PWN, Warsaw 2014. 3. Lillesand T.M., Kiefer R.W., Chipman J.W., Remote Sensing and Image Interpretation, 7th ed., Wiley, 2015. 4. Course materials and instructions provided by the instructor.
	Supplementary literature	1. Luhmann T., Robson S., Kyle S., Boehm J., Close-Range Photogrammetry and 3D Imaging, 4th ed., De Gruyter, 2023. 2. Wolf P.R., DeWitt B.A., Wilkinson B.E., Elements of Photogrammetry with Applications in GIS, 4th ed., McGraw-Hill, 2014. 3. Selected current scientific papers, technical documentation of the software used during the course, and materials on satellite and spatial data indicated by the instructor.
	eResources addresses	Basic https://badap.agh.edu.pl/publikacja/152176 - Podstawy fotogrametrii [Dokument elektroniczny] — [Basics of photogrammetry] / Krystian PYKA ; red. Krystian PYKA. — Wersja do Windows. — Dane tekstowe. — Kraków : Akademia Górniczo-Hutnicza im. Stanisława Staszica, 2024. — 137 s. — Wymagania systemowe: Adobe Reader. — Bibliogr. s. 131-137. — e-ISBN: 978-83-963036-5-3. — Publikacja dostępna online od: 2023-12-05. — Afiliacja Autora: Akademia Górniczo-Hutnicza im. Stanisława Staszica w Krakowie, Wydział Geodezji Górniczej i Inżynierii Środowiska Supplementary https://www.isprs.org/resources/education/ - ISPRS Book Series Webinar Records Textbook Tutorial Slides

Example issues/ example questions/ tasks being completed	1. Which sources of photogrammetric and remote sensing data can be used in the energy sector? 2. What are the differences between an orthophotomap, point cloud, terrain model, surface model and 3D model? 3. How do spatial, temporal and spectral resolution affect data usefulness? 4. Which factors determine the accuracy and currency of a study? 5. How can photogrammetry support the inventory of roofs, photovoltaic installations, transmission lines or hydraulic structures? 6. What are the possibilities and limitations of thermal and multispectral imagery? 7. How can changes be detected using images acquired at different times? 8. How can measurement results be distinguished from interpretation and engineering conclusions? 9. How should the reliability of a public spatial data source be assessed? 10. What benefits and risks are associated with automated image analysis and AI? 11. Selection of data and methods for a specified energy infrastructure problem. 12. Preparation of a basic analysis, map, model or 2D/3D visualisation and assessment of its limitations. 13. Comparison of at least two data sources in terms of resolution, currency and usefulness. 14. Presentation of project results in a short report and oral presentation
Practical activites within the subject	Not applicable

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