Satelite navigation systems and digital maps - course description

General information

Course name	Satelite navigation systems and digital maps
Course ID	06.0-WE-INFD-SNSaDM-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Computer Science
Education profile	academic
Level of studies	Second-cycle Erasmus programme
Beginning semester	winter term 2021/2022

Course information

Semester	2
ECTS credits to win	5
Course type	optional
Teaching language	english
Author of syllabus	• dr inż. Michał Doligalski

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	30	2	-	-	Exam
Laboratory	30	2	-	-	Credit with grade

Aim of the course

- Obtaining competences in the field of satellite navigation systems (GNSS) and digital maps and use them in IT projects
- To familiarize students with the use of GNSS systems, data acquisition, determination the level of confidence and accuracy of the data
- Developing skills in the use of GNSS system interfaces
- Shaping skills in the field of design and programming of applications with integrated digital maps.

Prerequisites

Scope

The genesis of GNSS systems, in particular, the GPS and Galileo systems. Overview of operational satellite navigation systems. Components of satellite navigation systems (user segment,
cosmic and control). The ability to obtain data and to integrate user segment devices with
other IT systems. The concept and principle of operation of satellite navigation systems. methods
distance measurement, position determination, azimuth, and speed. Distribution of time and frequency pattern. Reliability of information from GNSS systems and factors affecting performance and correctness determination of position and time (clock errors, ionosphere impact, tracking errors, multipath). Accidental and deliberate jamming and spoofing of satellite navigation systems. Registration, formats storing and analyzing data from GNSS systems. Application of GNSS systems in
civil and military solutions. Geographic information services and systems (GIS) using GNSS systems. Limitations of GNSS systems, possibilities and directions of further development.
Systems of satellite navigation augmentation. Digital map formats. Integration of digital maps in
applications, including mobile, GIS systems. Creating applications enabling, tracking and registration
position and its location on the map.

Teaching methods

Lecture: conventional and multimedia lecture.
Laboratory: laboratory exercises

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
A student who has completed the course: He understands the role of navigation systems satellite in contemporary computer science and electronics and is able to practically use them in the reality that surrounds him		• a quiz • an ongoing monitoring during classes	• Laboratory
He knows formal models and their features used in system design and applications for satellite navigation		• an exam - oral, descriptive, test and other	• Lecture
He can indicate the design stages systems and applications for navigation satellite and discuss architecture such a system		• an exam - oral, descriptive, test and other	• Lecture

Outcome description	Outcome symbols	Methods of verification	The class form
He can use specialist tools, design simple satellite navigation system and write an application to a location by using programming languages		• a quiz • an ongoing monitoring during classes	• Laboratory

Assignment conditions

- Lecture - A pass condition is to get a positive exam grade implemented in writing. The condition to take the exam is a positive assessment from the laboratory.
- Laboratory - the condition for passing is to get positive grades from everyone laboratory exercises planned for implementation as part of the laboratory program (80%) and active participation in classes (20%).
- Components of the final grade = lecture: 50% + laboratory: 50%

Recommended reading

1. Springer Handbook of Global Navigation Satellite Systems, Editors: **Teunissen**, Peter J.G., **Montenbruck**, Oliver (Eds.), Springer 2017
2. Global Positioning System, Theory and Applications, Volume I, J. Spilker & B. Parkinson, AIAA, 1996
3. GNSS: Global Navigation Satellite Systems, Bernhard Hofmann-Welenhof, Herbert Lichtenegger and Elmar Wasle, Springer-Verlag, 2007
4. An Introduction to GNSS: GPS, GLONASS, Galileo and Other Global Navigation Satellite Systems, Novatell (only PDF)

Further reading

1. Atmospheric Effects in Space Geodesy, **Böhm**, Johannes, **Schuh**, Harald (Eds.), Springer, 2013

Notes

Modified by dr inż. Michał Doligalski (last modification: 08-09-2021 21:18)