COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mobile and wireless technologies for the Internet of Things [S2EiT1-TMiB>TMiBIR]

Course

Field of study
Electronics and Telecommunications

Year/Semester
2/3

Area of study (specialization)
Mobile and Wireless Technologies

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
15

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

The student starting the course should know the operation of mobile radiocommunication systems, in particular in the field of the most important standards, architecture and operation of wireless local networks, 2G, 3G and 4G cellular systems, distributed mesh systems and radio access methods. Additionally, basic knowledge of the structure, operation and limitations of simple communication modules and electronic circuits used e.g. in sensor networks or M2M (in data exchange between autonomous devices, e.g. machines) is required. Basic knowledge of databases is also required. The student should be able to evaluate the parameters determining the quality of digital signal transmission in radio channels, as well as to compare the systems and standards of radio transmission and select the appropriate transmission method in specific transmission conditions while ensuring the simultaneous operation of many devices. Also required are the skills to use measuring devices and object-oriented programming with the use of languages such as C ++, C # or Java. The student should be able to find solutions to problems using various sources, and be ready to cooperate as part of a team. He should be aware of his skills, limitations, and the need for continuous education. He should also understand the importance of a professional approach to the task being performed and responsibility for the solutions developed.

Course objective

The course aims to provide students with knowledge about the principles of operation of wireless communication systems used for the construction of intelligent systems, including the so-called smart cities or other applications of the so-called Internet of Things (IoT). The course provides information on the theoretical basis and standards describing the principles of operation of IoT systems, as well as the collection, processing and analysis of large volumes of data (the so-called big data). Students also acquire the skills to configure and operate a network connecting multiple IoT devices and to collect the transferred data.

Course-related learning outcomes

Knowledge:
1. Has an organized knowledge of the operation of communication systems for the needs of the so called Internet of Things, including autonomous systems.
2. Knows the basic standards of wireless communication for IoT systems.
3. Has a solid understanding of the problems and limitations of communication between IoT devices.
4. Knows the basic methods of collecting and processing large volumes of data.

Skills:
1. Can analyze the standards of modern radio communication systems in English.
2. Can identify the characteristics of IoT wireless communication systems, compare them and assess their performance.
3. Can choose the wireless communication standard depending on the functionality and requirements of the devices supported.
4. Can apply the mechanisms of data collection and analysis in an IoT network.

Social competences:
1. Is aware of his knowledge and skills, and the limitations related to them. Understands the necessity of further education related to the rapid aging of knowledge and skills in the field of IoT systems.
2. Understands the importance of radio communication standards in the operation of the Internet of Things systems.
3. Has a sense of responsibility for the implementation of the design of the communication system between IoT devices and its importance for the environment and man.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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The knowledge acquired during the lectures is verified during the exam, which can be written or oral. The written exam consists of 6-10 questions (test and / or open) that can be scored differently. The pass mark for the written exam is 51% of the points available. The oral exam consists of 3 questions related to the subject of the lectures, which are assessed on a scale of 2-5, taking into account the understanding of the issue by the student, as well as the detailed answers. The pass mark for the oral exam is 51% of positively assessed answers to the questions.
The skills and competences acquired during the implementation of project classes are assessed on the basis of the implementation of an extensive task - project - on the subject agreed with the student. The tasks are performed in groups and concern the implementation and configuration of the communication system between IoT devices. The final evaluation of the project, on a scale of 2-5, depends on the degree of complexity of the task, completed stages / functionalities, as well as the student"s involvement in the project

Programme content

The lectures cover the following topics:
- Introduction to IoT, Industry 4.0, smart city (various concepts), etc.
- Overview of frequency bands used in IoT communication.
- Concept discussion and review of Smart Grids and Smart Metering, Smart Industry, Smart Building, Smart Health, Smart Vehicles, Smart Cities, Smart Government systems.
- Discussion of the existing and planned standards (or standardization works) used in IoT systems.
- Discussing the methods of collecting data (databases) with particular emphasis on handling large

volumes.
- Presentation of the Big Data Analysis problem - a discussion of learning algorithms, data processing, crowdsourcing, or MEC / Fog computing.
The subject of the project includes the use of a selected technology (communication standard) to implement a communication system between selected IoT devices, as well as the development of solutions enabling data collection and analysis.

Teaching methods

Lectures: multimedia presentation with elements of a seminar lecture - discussion on various problems and solutions.
Project: Implementation of a project task - group work - development and construction of an IoT wireless communication system for a selected functionality

Bibliography

Basic
Krzysztof Wesołowski, "Systemy radiokomunikacji ruchomej", Wydawnictwa Komunikacji i Łączności, 1999
Additional
Martin Kleppmann, "Przetwarzanie danych w dużej skali : niezawodność, skalowalność i łatwość konserwacji systemów", Helion, 2018.
Christoph Sommer, Falko Dressler, "Vehicular networking", Cambridge University Press, 2015
Boris Adryan, Dominik Obermaier, Paul Fremantle, "The Technical Foundations of IoT", Artech House, 2017

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	58	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	42	2,00