

Wireless sensor networks - course description

General information	
Course name	Wireless sensor networks
Course ID	11.9-WE-AutP-WSN-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics .
Field of study	Automatic Control and Robotics
Education profile	academic
Level of studies	First-cycle Erasmus programme
Beginning semester	winter term 2022/2023

Course information	
Semester	6
ECTS credits to win	3
Course type	optional
Teaching language	english
Author of syllabus	<ul style="list-style-type: none">dr inż. Emil Michta, prof. UZdr inż. Piotr Powroźnik

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	15	1	-	-	Credit with grade
Laboratory	30	2	-	-	Credit with grade

Aim of the course

Skills and competence within: design and configuration ZigBee wireless sensor networks. Writing of application programs in C or Java for ZigBee nodes. Creating of application profiles for ZigBee. Use of security solutions for data transmission protection in ZigBee networks.

Prerequisites

Microprocessor systems, Intelligent measurement transducers

Scope

Introduction to sensor networks. Evolution of WPAN wireless networks. Wireless networks IEEE 802.15.x. Processors for wireless network nodes. Supply issues of wireless sensor networks. Application areas of sensor networks.

Sensor networks. Sensor networks topology. Physical layer and data layer of wireless sensor networks – IEEE 802.15.4. Network layer and application layer – ZigBee standard.

ZigBee. Architecture of ZigBee protocol. ZigBee network functioning. Kinds and functioning of ZigBee nodes. Central managing and routing. Domens, clusters and profiles in ZigBee networks. Configuration of ZigBee networks. Implementation of security solution on MAC layer, network layer and application layer. Addressing and binding of variables. Application areas and application profiles.

Bluetooth. Architecture of Bluetooth protocol. Functioning of Bluetooth networks. Implementation of measurement – control functions.

Nodes of WPAN. Types and functions of ZigBee and Bluetooth network nodes. Design of ZigBee and Bluetooth network nodes.

Design and analysis of communication features in sensor networks. Choose of designed network topology. Coordinator and network configuration. Calculation of communication parameters for designed network. ZigBee sensor network simulation. Examples of applications. Wireless sensor networks in IoT

Teaching methods

Lecture: conventional lecture, discussion, consultation.

Laboratory: laboratory exercises, group work, discussion, consultation.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Knows and understands the basics of wireless sensor network design and configuration methodology		<ul style="list-style-type: none">a test	<ul style="list-style-type: none">Lecture
Is aware of the benefits resulting from the use of wireless solutions in measurement- control systems		<ul style="list-style-type: none">a test	<ul style="list-style-type: none">Lecture
Has the basic knowledge in the area of the construction, operation and architecture of wireless sensor networks		<ul style="list-style-type: none">a test	<ul style="list-style-type: none">Lecture

Outcome description	Outcome symbols	Methods of verification	The class form
Can use programming environments and software tools used to create the software for sensor network nodes		<ul style="list-style-type: none"> an observation and evaluation of the student's practical skills 	<ul style="list-style-type: none"> Laboratory
Can build, start and test a simple wireless sensor network		<ul style="list-style-type: none"> an observation and evaluation of the student's practical skills 	<ul style="list-style-type: none"> Laboratory

Assignment conditions

Lecture – the pass condition is to get good ratings from written tests carried out twice a semester.

Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

Calculation of the final Grade: lecture 50% + laboratory 50%

Recommended reading

1. Mahmoud H., Fahmy A.: Wireless Sensor Networks: Concepts, Applications, Experimentation and Analysis, Springer, 2016
2. Ammari H. M.: The Art of Wireless Sensor Networks: Volume 1: Fundamentals, Springer Science & Business Media, 2013
3. Raghavendra C.S., Sivalingam K.M., Znati T.: Wireless Sensor Networks. Kluwer Academic Publisher, 2005.
4. Zhao F., Gibas L.: Wireless Sensor Networks. An Information Processing Approach. Elsevier, 2004

Further reading

1. ZigBee Alliance. ZigBee PRO 2015 (R21) Specification
2. Faludi R.: Building Wireless Sensor Networks: with ZigBee, XBee, Arduino, and Processing, O'Reilly Media, 2010

Notes

Modified by dr inż. Emil Michta, prof. UZ (last modification: 14-04-2022 21:51)

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