



COURSE DESCRIPTION CARD - SYLLABUS

Course name

IOT: SENSOR DATA ACQUISITION AND ANALYSIS [S5ITIT>GADS]

Course

Proposed by Discipline

–

Year/Semester

3/6

Level of study

Doctoral School

Course offered in

English

Form of study

full-time

Requirements

elective

Number of hours

Lecture

8

Laboratory classes

0

Other

0

Tutorials

0

Projects/seminars

0

Number of credit points

2,00

Coordinators

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Lecturers

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Prerequisites

Students starting this course should have basic knowledge of data representation, processing, and presentation. A basic knowledge of digital electronics, microcontrollers, and microprocessors. He should have knowledge to be able to design and implement computer programs in chosen programming languages (e.g., C, Python) and have a basic knowledge about databases.

Course objective

To provide students with knowledge in the field of Sensor Data Acquisition and Analysis of IoTs. Students will learn how to choose the appropriate sensor and microcontroller to collect the required information. The course will present a typical procedure to analyze the data using AI tools.

Course-related learning outcomes

Knowledge:

A PhD graduate knows and understands the following:

- 1) How to select or build the whole chain of data acquisition, preprocessing, and analysis. [P8S_WG/SzD_W01], [P8S_WG/SzD_W02], [P8S_WG/SzD_W03];
- 2) How to choose appropriate sensors and analyze the collected data to solve a given scientific problem [P8S_WG/SzD_W03];
- 3) How to use IoT devices in different applications, such as education and medicine, [P8S_WG/SzD_W02].

Skills:

A Ph.D. graduate can:

- 1) Choose appropriate existing sensors for a given problem and effectively interpret collected data [P8S_UW/SzD_U01] and [P8S_UW/SzD_U02];
- 2) Set up and operate a simple IoT device and use it in commercial and social applications [P8S_UW/SzD_U03].

Social competences:

A Ph.D. graduate is ready to:

- 1) prepare a data set and analyze complex scientific data also with the help of AI models [P8S_KK/SzD_K01], [P8S_KK/SzD_K03];
- 2) understand the importance of using the latest techniques and tools, such as IoT and AI, to solve research and practical problems P8S_KK/SzD_K03];
- 3) be aware of the need for a professional approach when using IoT and AI, as well as taking responsibility for the results obtained with these tools [P8S_KO/SzD_K04].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Active participation in discussions and solving small exercises. Preparing a short report related to a chosen data type acquisition and processing.

Programme content

This course presents the complete process of measuring selected, exemplary physical quantities using sensors. It covers the operating principles of selected sensors, analog-to-digital data conversion, and data processing and analysis. The course familiarizes students with the fundamentals of microcontroller architecture and programming from a system user's perspective. It also presents selected methods for analyzing sensor data using AI models.

The course is illustrated with example applications in the fields of medicine, autonomous vehicles, and drones (UAVs).

Course topics

1. Sensors: definition and classification.
2. An overview of the operating principles of selected sensors.
3. Using a microcontroller for sensor data acquisition and processing.
4. Examples of AI models for analysing selected data sets.
5. Case studies of example applications (e.g. medicine, UAVs).

Teaching methods

Lectures: multimedia presentations, illustrated with examples given on the blackboard.

Bibliography

Basic:

1. Dominique Guinard, Vlad Trifa: Building the Web of Things, Manning Publications, June 2016. ISBN 9781617292682.
2. Jerzy Kluczewski: Internet rzeczy IoT i IoE w symulatorze Cisco Packet Tracer. Praktyczne przykłady i ćwiczenia. Seria Packet Tracer, Wydawnictwo iTstart, 2018.

Additional

1. Amita Kapoor: Hands-On Artificial Intelligence for IoT: Expert machine learning and deep learning techniques for developing smarter IoT systems, Packt Publishing, 2019.
2. Colin Dow: Mastering IoT, Packt Publishing, 2019. EAN: 9781838645434
3. Marcin Sikorski, Adam Roman: Internet Rzeczy, Wydawnictwo Naukowe PWN 2020. ISBN: 9788301208400

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	8	0,50
Doctoral student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation)	42	1,50