COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamental of IoT [S1Cybez1>IoT]

Course

Field of study
Cybersecurity

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
16

Laboratory classes
24

Other
0

Tutorials
0

Projects/seminars
8

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

A student starting this course should have basic knowledge of digital electronics, microcontrollers, and microprocessors. They should possess knowledge that enables them to design and implement computer programs in selected programming languages (e.g., C, Python). Additionally, they should be able to acquire information from designated sources and be prepared to work in a team. In terms of social competencies, they must demonstrate attitudes such as honesty, responsibility, perseverance, intellectual curiosity, creativity, personal culture, and respect for others.

Course objective

The objectives of the course are: - To familiarize students with the fundamentals of IoT technology and its applications in various fields. - To develop skills in designing and implementing IoT systems. - To provide knowledge about security and protection in IoT systems. - To prepare students for teamwork in engineering solutions.

Course-related learning outcomes

Knowledge:
- The student knows the basic concepts and architecture of IoT systems. [K1_W07]

- Understands communication technologies and protocols used in IoT. [K1_W14]
- Has knowledge of the challenges related to IoT security. [K1_W17]

Skills:
- Is able to design and implement simple IoT systems. [K1_U02]
- Can integrate IoT devices with a cloud platform. [K1_U09]
- Is able to analyze data generated by IoT devices. [K1_U04]

Social competences:
- Understands the need for continuous learning in the rapidly evolving field of IoT. [K1_K01]
- Is aware of the responsibility for designing and implementing systems in accordance with security and privacy principles. [K1_K05]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. Knowledge: A written test with questions on IoT architecture, technologies, and security.
2. Skills: Ongoing assessment of laboratory task execution.
3. Project: Evaluation based on the completion of a team project, presentation of results, and documentation

In each form of the course assessment, the grade depends on the number of points the student earns relative to the maximum number of required points. Earning at least 50% of the possible points is a prerequisite for passing. The relationship between the grade and the number of points is defined by the Study Regulations. Additionally, the course completion rules and the exact passing thresholds will be communicated to students at the beginning of the semester through the university's electronic systems and during the first class meeting (in each form of classes).

Programme content

The course "Fundamentals of IoT (Internet of Things)" introduces students to key concepts related to the design, implementation, and management of IoT systems. It covers fundamental IoT architecture concepts, communication technologies, network protocols, security measures, and the analysis of data generated by IoT devices.
Students gain practical skills in designing IoT systems, programming devices, enabling communication between them, and analyzing data. As part of project-based learning, participants develop prototype IoT solutions that consider real-world applications in industry, smart homes, and future cities (Smart Cities).

Course topics

I. Introduction to IoT
1. Basic Concepts and Definitions
- Internet of Things: definition, role, and applications.
- IoT architecture: edge devices, gateways, cloud, and applications.
- IoT device lifecycle: design, deployment, and management.
2. IoT Applications
- IoT in industry (Industrial IoT).
- Smart homes (Smart Home) and smart cities (Smart Cities).
- IoT in healthcare, transportation, and energy.
3. Communication Technologies and Protocols
- Basics of IoT communication: Wi-Fi, Bluetooth Low Energy (BLE), ZigBee, LoRaWAN, NB-IoT
- Communication protocols: MQTT, CoAP, HTTP.
II. IoT System Design and Implementation
1. IoT Devices
- Types of sensors and actuators used in IoT.
- Microcontrollers and hardware platforms (e.g., Arduino, Raspberry Pi, ESP32).
2. Device Integration
- Basics of microcontroller programming.
- Communication between IoT devices and the cloud.
3. IoT Data Analysis
- Capturing and processing data from devices.

- Data storage and analysis in cloud systems.
- Using Python for processing large datasets.
III. IoT Security Fundamentals
1. Key IoT Security Threats and Challenges
- Privacy concerns and vulnerabilities of IoT devices.
- Fundamental security mechanisms: encryption, authentication, and access control.
2. Secure IoT System Design
- Certificate and key management in IoT systems.
- Device software monitoring and updates.
IV. Practical Aspects: Labs and Project
1. Laboratories
- Configuring IoT devices and implementing basic functions.
- Practical implementation of communication protocols (e.g., MQTT).
- Developing simple IoT systems for environmental monitoring (e.g., temperature, humidity).
2. Group Project
- Developing a prototype IoT system for a selected application scenario.
- Integrating IoT devices with a cloud platform and creating data visualizations.
- Project presentation and results analysis.

Teaching methods

- Lectures with case study analysis of IoT applications.
- Laboratory exercises covering the configuration and programming of IoT devices.
- Group project work focused on developing prototype IoT systems.

Bibliography

Basic:
1. "Internet of Things: Principles and Paradigms" - Rajkumar Buyya, Amir Vahid Dastjerdi. 2016
2. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" - David Hanes, Gonzalo Salgueiro, Patrick Grossetete. 2017
3. Dokumentacja techniczna platform sprzętowych (Arduino, Raspberry Pi, ESP32).
4. Materiały dydaktyczne przygotowane przez prowadzących.

Additional:
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Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,00
Classes requiring direct contact with the teacher	48	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	42	1,50