COURSE DESCRIPTION CARD - SYLLABUS

Course name
Internet of Things [S1MiKC1>IR]

Course

Field of study
Microelectronics and digital communications

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

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_W05]

- Understands communication technologies and protocols used in IoT. [K1_W20]
- Has knowledge of the challenges related to IoT security. [K1_W24]

Skills:
- Is able to design and implement simple IoT systems. [K1_U10]
- Can integrate IoT devices with a cloud platform. [K1_U11]
- Is able to analyze data generated by IoT devices. [K1_U14]

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_K04]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge gained from lectures is assessed through a final assessment. The assessment is written and consists of 45-60 multiple-choice questions, true/false questions, and open-ended questions. Students receive one point for each correct answer, and a minimum of 50% of the total points is required to pass the assessment.
The knowledge and skills acquired in exercises are assessed based on student activity during classes (20%) and a final assessment (80%). The final assessment consists of 5-10 tasks to be solved, with the number of points awarded for each task depending on the complexity of the question. To pass the test, students must score at least 50% of the total points.

Programme content

The course "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.

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).

Teaching methods

- Lectures with case study analysis of IoT applications.
- Laboratory exercises covering the configuration and programming of IoT devices.

Bibliography

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

Additional:
1. "Internet rzeczy. Podstawy programowania aplikacji i serwerów sieciowych w językach C/C++, MicroPython i Lua na urządzeniach IoT ESP8266, ESP32 i Arduino" Mariusz Duka, Helion, 2023
2. "Internet rzeczy" Marcin Sikorski, Wydawnictwo Naukowe PWN, 2020

Breakdown of average student's workload

	Hours	ECTS
Total workload	85	3,00
Classes requiring direct contact with the teacher	45	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50