



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Internet of Things applications

Course

Field of study

automatic control and robotics

Area of study (specialization)

Level of study

First-cycle studies

Form of study

part-time

Year/Semester

4/8

Profile of study

general academic

Course offered in

polish

Requirements

elective

Number of hours

Lecture

8

Laboratory classes

18

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

PhD eng. Dominik Łuczak

Responsible for the course/lecturer:

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Prerequisites

Knowledge: A student starting this subject should have basic knowledge of electronics and basic programming.

Skills: The student should have the ability to solve basic problems in the field of digital signal processing and the ability to obtain information from specified sources. He should also understand the need to expand his competences and be ready to cooperate in a team.

Social competences: In addition, in the area of social competences, the student must exhibit such qualities as honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture, respect for other people.



Course objective

The aim of the course is to learn the theoretical foundations, principles of operation and possible applications of devices communicating with other objects of a distributed control system without human intervention (Machine to Machine, M2M) both wired and wirelessly through a global Internet network. The student after completing education should be able to:

- 1) develop a simple application for a mobile device allowing remote management of a selected item connected to the global network,
- 2) develop a device enabling communication with other objects on the Internet,
- 3) prepare the user interface for remote management of one and several objects.

Course-related learning outcomes

Knowledge

1. Student knows and understands typical engineering technologies, principles and techniques for constructing simple automation and robotics systems; knows and understands the principles of selection of executive systems, computational units as well as measuring and control elements and devices - [K1_W20],
2. is aware of the current state and the latest development trends in the field of automation and robotics - [K1_W21],
3. knows and understands the fundamental dilemmas of modern civilization associated with the development of automation and robotics - [K1_W28].

Skills

1. Student is able to plan, prepare and simulate the operation of simple automation and robotics systems - [K1_U10],
2. is able to select the type and parameters of the measurement system, control unit and peripheral and communication modules for the selected application and integrate them in the form of the resulting measurement and control system - [K1_U22],
3. is able to develop a solution to a simple engineering task and implement, test and run it in a selected programming environment on a PC for selected operating systems - [K1_U26].

Social competences

1. The student is aware of the importance and understands the non-technical aspects and effects of engineering activities, including its impact on the environment and the associated responsibility for decisions; is ready to care for the achievements and traditions of the profession; - [K1_K2]
2. is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions in which the devices and their elements can function - [K1_K5]



Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative assessment:

a) in the scope of lectures:

based on answers to questions about the material discussed in previous lectures,

b) in the scope of the laboratory:

based on assessment of knowledge and understanding of current issues presented in the course of the subject.

Summative rating:

a) in the scope of lectures, verification of assumed learning outcomes is carried out by:

i. assessment of knowledge and skills demonstrated during the test written exam.

ii. discussion of exam results,

b) in the scope of laboratory, verification of assumed learning outcomes is carried out by:

i. assessment of student's preparation for individual classes,

ii. continuous assessment, during each class (oral answers) - rewarding the increase in the ability to use known principles and methods,

iii. assessment of reports prepared partly during classes and also after their completion,

iv. development of a control and measurement system.

Obtaining additional points for activity during classes, in particular for:

i. independent construction of the electronic control and measurement system module and preparation of documentation

ii. effectiveness of applying the acquired knowledge while solving a given problem

iii. comments related to the improvement of teaching materials.

Programme content

The lecture program includes the following topics:

1. Elements and tasks of the Internet of Things application, system construction, market, development modules, programming environments. Motivation to learn. Data exchange format between systems - JSON, Restful interface.

2. Web applications with a restful interface developed in PHP.



3. Linux operating system configuration - GPIO, SPI, UART, I2C configuration.
4. Linux system - access rights, shell scripts, user creation, SSH remote access.
5. Applications for mobile devices with Restful interface.
6. Web interface structure - HTML, jQuery. Web interface interaction - JS, jQuery. Presentation of the web interface - CSS, Bootstrap.
7. Linux operating system configuration - CRON configuration, startup files, network settings.
8. Ethernet, IP, TCP, UDP protocols. Addressing in the network - DHCP, ARP.
9. HTTP, application layer protocols, MQTT. Security of network applications - TLS.

The program of laboratory classes includes the following issues:

1. Organizational classes - familiarization with OHS apparatus and footnotes, introduction to the design environment. JSON data exchange format.
2. Implementation of the restful interface in PHP
3. Linux operating system configuration - GPIO, SPI, UART, I2C configuration
4. Developing an application for Linux to support GPIO, SPI, UART, I2C interfaces (preferably C language).
5. Paper user interface design. Application development for Android - as a user interface.
6. Implementation of the interface for WWW - HTML, jQuery. Implementation of the interface for WWW - Bootstrap
7. Implementation of the web interface - charts and notifications.
8. Application of signal processing algorithms to analyze signal features.
9. Development and testing of the control and measurement system.

Teaching methods

1. Lecture: multimedia presentation illustrated with computer simulations and a real system
2. Laboratory classes: the use of single-board development modules with a set of sensors, programming environments for Internet applications

Bibliography

Basic

1. Ilya Grigorik, Wydajne aplikacje internetowe. Przewodnik, Helion, 2014 / Ilya Grigorik, High Performance Browser Networking, 2013



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Additional

1. Karol Rogowski, Świat poza jQuery : biblioteki : AngularJS, KnockoutJS i BackbonesJS, Wydawnictwo Naukowe PWN, 2014.
2. Arkadiusz Mystkowski, Sieci przemysłowe PROFIBUS DP i PROFINET IO, Oficyna Wydawnicza Politechniki Białostockiej, 2012.
3. Zimmermann W., Schmidgall R.: Magistrale danych w pojazdach. Protokoły i standardy, Wydawnictwa Komunikacji i Łączności 2008
4. Komunikacja danych cyfrowych w pomiarach i sterowaniu - Część 1: Zbiór profili do wytwarzania ciągłego i dyskretnego związany z magistralą miejscową stosowaną w przemysłowych systemach sterowania PN-EN 61784-1, Polski Komitet Normalizacyjny, 2005.
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6. Troy Miles, jQuery Essentials, 2016.
7. Raimond Pigan, Mark Metter, Automating with PROFINET: Industrial Communication Based on Industrial Ethernet, 2nd Edition, 2015.
8. Bruce Hartpence, Packet Guide to Routing and Switching, 2011.
9. Łuczak D., Remote laboratory with WEB interface, Computer Applications in Electrical Engineering, Vol. 9, str. 257-268, Poznań, 2011, ISSN 1508-4248.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	24	0,9
Student's own work (literature studies, preparation for laboratory classes, preparation for tests, tasks preparation) ¹	56	2,1

¹ delete or add other activities as appropriate