COURSE DESCRIPTION CARD - SYLLABUS

Course name
Intelligent Homes and Buildings

Course

Field of study
Computer Science

Year/Semester
1/2

Area of study (specialization)
Mobile and Embedded Applications for the Internet of Things

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
16	16	
Tutorials	Projects/seminars	

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:
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Prerequisites

A student starting the course Intelligent Houses and Buildings should have knowledge of the basics of automation, PLC programming, real-time and embedded distributed operating systems and mobile systems programming.

Course objective

The aim of the course is to present basic knowledge on the application of appropriate methods and tools in systems for technical management of home and building equipment and intelligent buildings, learning about electronic systems used in building automation, implementation of intelligent control algorithms in intelligent buildings, acquiring skills in programming controllers managing building installations, using mobile devices to manage building installations and low energy wireless networks (LPWAN).

Course-related learning outcomes

Knowledge

1. has an extensive and in-depth knowledge of the construction of IT systems supporting the management of building infrastructure,

2. has a structured and theoretically underpinned knowledge of remote systems, distributed systems, real-time systems and network techniques used in intelligent building management systems,

3. has advanced detailed knowledge of databases, cloud computing and network communication used to manage intelligent buildings,

4. has knowledge of development trends and the most important new developments in computer science and related scientific disciplines, such as automation and control theory,

5. has advanced and detailed knowledge of the life cycle of control systems and control and measurement systems used and applied in building automation systems.

Skills

1. is able to obtain information from literature, databases and other sources (in his native language and English), in the field of intelligent building management,

2. is able to use information and communication techniques when developing requirements for the functioning of IT building infrastructure management systems,

3. is able to use advanced simulation methods to solve simple research problems in designing intelligent algorithms for controlling building installations,

4. is able to integrate knowledge of computer science, automation and control theory when formulating and solving engineering tasks,

5. is able to identify elements and control systems and formulate a design specification of a complex control system for building installations taking into account non-technical aspects,

6. is able to design an IT system supporting the BMS operator in an intelligent building,

7. is able to cooperate in a team assuming the roles of a designer, contractor and reviewer of the developed intelligent building infrastructure management system,

8. is able to determine the directions of its further development in the field of designing advanced integrated intelligent building management systems.

Social competences

1. understands the importance of using the latest IT knowledge to solve problems related to the construction of modern building infrastructure management systems,

2. Understands the importance of popularizing the latest developments in the field of IT systems supporting the management of building systems,

3. is aware of the need to develop the professional achievements by expanding knowledge of modern solutions in the field of intelligent building management.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired in the course of the lecture is verified by a written examination conducted in an examination session. The examination consists of 5 open questions. The pass marker threshold: 50%. The issues on the basis of which the examination questions are prepared will be embedded on the lecturer's website at least one week in advance.

Skills acquired during the laboratory classes are verified on the basis of a report presenting the developed infrastructure management system of the intelligent home and building. The report is prepared according to the diagram given by the lecturer. The given scheme organizes the rules of assessment.

Programme content

The lecture program includes the following issues: Definition of an intelligent building. Classes of intelligent buildings. Levels of building systems integration. Installation categories in intelligent buildings. Integration of building systems. Intelligent installations in public buildings, multi-family buildings and single-family buildings. Intelligent installations in industrial buildings (production halls). Functions of home and building automation systems. Development of building automation systems and principles of integration of building installations. Open and closed systems of managing installations in intelligent buildings. BMS systems. BAS systems. Genesis, basic features and principles of operation of the most popular standards of integrated building automation systems: KNX/EIB, LonWorks, BACnet, LCN, Desigo, Synco, X10, xComfort, PowerNet, RadioBus. Elements of building automation systems - sensors, actors, communication buses. Communication methods in building automation systems - addressing, telegrams, data formats, bus access rules. Wireless networks in building automation. Monitoring the status of building installations. Protection against electric shock and surge. Basic installation control algorithms: HVAC, SMS, DMS, CCTV, DSO. Intelligent algorithms for controlling building installations. Energy and ecological aspects of intelligent building. Aspects of management and operation of an intelligent building in economic and ecological terms. Issues of remote management of installations in houses and buildings from the level of mobile devices. The use of low energy wireless networks (LPWAN) in intelligent houses and buildings. The idea of BIoT (Building Internet of Things). EU standards for the design, construction and operation of intelligent houses and buildings in the context of intelligent building installations and their control/management. The issues of microclimate comfort management.

Laboratory classes are conducted in the form of four 4-hour exercises, held in the laboratory. The exercises are carried out by 2-person teams of students. The program of laboratory classes includes the following issues: design of control algorithms for selected building installations. Simulation of building (room) models and automatic control systems in Matlab environment. Design of synoptic screens of SCADA system for intelligent building. Implementation of control algorithms on controllers or microcontrollers. Implementation of synoptic screens on touch panels (industrial computer) or on a

server. Performing the process of verification and validation of the developed control system, monitoring and visualization of building installations. Design and implementation of installation control algorithms in a dedicated laboratory building model. Verification of developed algorithms for controlling installations: access (alarm), heating and air-conditioning, lighting, roller shutters. Project of remote control and monitoring of building installations from the level of mobile device using low energy wireless network (LoRaWAN) and IoT class terminal devices. Design of Smart Metering system with the use of intelligent electricity meter and single plate computer.

Teaching methods

Lecture: multimedia presentation, multimedia show, demonstration of the work of a sample building automation system.

Laboratory classes: performing experiments, teamwork, workshops, demonstration of developed building automation systems.

Bibliography

Basic

1. Budynek inteligentny. Tom I. Potrzeby użytkownika a standard budynku inteligentnego, Niezabitowska E. (red), Wyd. Politechniki Śląskiej, Gliwice, 2010

2. Budynek inteligentny. Tom II. Podstawowe systemy bezpieczeństwa w budynkach inteligentnych., Niezabitowska E. (red), Wyd. Politechniki Śląskiej, Gliwice, 2010

3. Inteligentny dom - Automatyzacja mieszkania za pomocą platformy Arduino, systemu Android i zwykłego komputera, Mike Riley, Wyd. Helion, Gliwice, 2016

Additional

1. Nowoczesne wyposażenie techniczne domu jednorodzinnego, Koczyk H., Antoniewicz B., PWRiL, Poznań, 2004

2. Instalacje elektryczne, Markiewicz H., WNT, Warszawa, 2008

3. Nowoczesne wyposażenie techniczne domu jednorodzinnego. Instalacje elektryczne, Sroczan E., M., PWRiL, Warszawa, 2019

4. Nowak M., Urbaniak A., Rozwój systemów automatyki i zarządzania w budynkach, [w:] rozdział w monografii pt. Innowacyjne wyzwania techniki budowlanej, Lech Czarnecki (red.), Wyd. Instytut Techniki Budowlanej, Warszawa, Polska 2017 r., (241-260)

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	32	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	68	3,0

[1] delete or add other activities as appropriate