COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mobile and cloud technologies [S2AiR2-ISA>TMiCH]

Course

Field of study
Automatic Control and Robotics

Year/Semester
1/1

Area of study (specialization)
Intelligent Control Systems

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Knowledge: Students starting this subject should have knowledge of automation and robotics corresponding to level 6 of the Polish Qualifications Framework, in particular knowledge of programming and data structures. Skills: The student should have the ability to solve and implement programming problems in the field of automation and robotics, as well as the ability to obtain information from specified sources. Student 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

1. Providing students with knowledge of remote systems, distributed real-time systems and network techniques using mobile and cloud technologies. 2. Developing students' skills to develop a control and measurement system as well as its implementation and launching in a programming environment using mobile and cloud technologies. 3. Developing in students the importance of knowledge of technology and recommendations related to the construction and programming of a remote control and measurement system using mobile and cloud technologies.

Course-related learning outcomes

Knowledge:
1. Student has specialist knowledge in the field of remote and distributed systems, real time systems and network techniques; [K2_W3]
2. has knowledge of development trends and the most important new achievements in the field of automation and robotics and related scientific disciplines [K2_W12]

Skills:
1. Student is able to use information and communication techniques; [K2_U8]
2. is able to critically assess and select the appropriate methods and tools to solve the task in the field of automation and robotics; is able to use innovative and unconventional tools in the field of automation and robotics; [K2_U22]
3. is able to construct an algorithm for solving a complex and unusual engineering task and a simple research problem as well as implement, test and run it in a selected programming environment for selected operating systems; [K2_U25]
4. is able to construct an algorithm for the solution of a complex measuring and computing-control task as well as implement, test and run it in a selected programming environment on a microprocessor platform; [K2_U26]

Social competences:
1. The student is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions in which devices and their components can function; [K2_K4]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The learning outcomes presented above are verified in the following way:
Formative assessment:
a) in terms of lectures:
based on homework assignments and answers to questions about the material covered in previous lectures,
b) within the scope of the laboratory:
based on the assessment of knowledge and understanding of current issues presented in the course.
c) In both forms of classes, it is possible to use Problem-Based Learning (PBL) tasks that support the current research and technical needs of the course coordinator and are supervised by the instructor, taking into account the iterative and cyclical nature of task implementation, provided that they are consistent with the course content.

Summary rating:
a) in the field of lectures, verification of the assumed learning outcomes is carried out by:
i. assessment of knowledge and skills demonstrated on a multiple-choice test
ii. discussion of the results.
b) in the laboratory, verification of the assumed learning outcomes is carried out by:
i. assessment of the student's preparation for individual classes,
ii. continuous assessment in each class (oral answers) - rewarding the increase in the ability to use the learned principles and methods,
iii. assessment of tasks prepared partly during classes, as well as after their completion.
c) The summative assessment may include the results of Problem-Based Learning (PBL) assignments developed for the research and technical needs of the course coordinator and supervised by the instructor, provided they are consistent with the course curriculum.
d) Obtaining additional points for activity during classes, in particular for:
i. independent construction of a distributed system consisting of several electronic modules with microprocessors cooperating with the database control and measurement system developed during classes and preparation of documentation,
ii. effectiveness of applying acquired knowledge when solving a given problem
iii. comments related to the improvement of teaching materials.

Programme content

The subject covers a wide range of issues related to mobile and cloud technologies, with emphasis on their use in control and measurement systems. Students learn about various cloud computing models, communication protocols, data exchange formats, databases (SQL and NoSQL), object-relational mapping, programming framework (Yii), remote application programming, use of sensors in devices, communication with databases, security of cloud systems and wearable systems.

During the lectures, students learn the theoretical foundations and gain practical skills through laboratory exercises. They include designing databases, performing CRUD operations, generating application skeletons, handling sensors, data acquisition, communication with databases, data analysis, security and performance of distributed systems.

The course program provides comprehensive preparation for working with mobile and cloud technologies in the context of control and measurement systems. Students will acquire the knowledge and skills necessary to design, create and implement systems using data from sensors and cloud databases.

Course topics

The lecture program covers the following topics:
1. Types of cloud computing models and their applications. Communication protocols used in remote systems including real-time communication. Types of exchange formats data. JSON data description format.
2. (SQL) Designing a database for control and measurement systems (SQL, NoSQL). Discussing relationships: one to one, one to many, many to many. Types of MySQL, SQLite and databases PostgreSQL.
3. (SQL) Operations performed on databases - CRUD. Collecting and searching data from measurement systems.
4. (SQL/Yii) Object-relational mapping including the model-view-controller approach. Preparing data from the control and measurement system to the model, view and management.
5. (Yii) Controllers describing the behavior of mobile applications. Overview of creating controllers in Yii PHP Framework.
6. (Yii) Models mapping database tables. Overview of creating models in the Yii PHP Framework.
7. (Yii) Views presenting data from models describing the control and measurement system. Discussing creating views in Yii PHP Framework.
8. (Yii) Forms and filters used to parameterize the control and measurement system. Discussing creating forms and filters in Yii PHP Framework.
9. Use of edge device sensors (e.g. accelerometer and vision sensor).
10. Real-time communication between the edge application and the database. Performing the operation Data-based CRUD.
11. Using an edge device (e.g. smartphone) as a measurement platform. Uploading data from sensors to the database. Visualization of collected data.
12. Use of an edge device as a control and measurement platform. Using a mobile device in upcycling (forms of waste recycling). Processing data from sensors and database on a mobile device - edge processing clouds.
13. Distributed control and measurement system.
14. Security of cloud systems. Overview of the TSL protocol.
15. Wearable systems.

The laboratory program includes:
1. Describing various data structures using JSON. Validation of the obtained results in parser.
2. (SQL) Computer-designed SQL database for the control and measurement system consisting of several different microprocessor devices and mobile devices.
3. (SQL) Performing CRUD operations on a sample database. Performing complex operations with combining query results.
4. (SQL/Yii) Generation of application framework based on the database. Gii Generator. Yii configuration.
5. (Yii) Controllers describing the behavior of the application. Implementation using Yii.
6. (Yii) Models mapping database tables. Implementation using Yii.
7. (Yii) Views describing the appearance of the application. Implementation using Yii.
8. (Yii) Forms and data filtration in models and controllers. Data Validity Analyzer

entered in the forms.
9. Support for available edge or mobile device sensors. Data sampling and processing digital, taking into account the sampling period.
10. Data acquisition from available sensors of an edge or mobile device. Data sampling i uploading to database. Development of a measurement system.
11. Communication of an edge or mobile device with the database. Search, remove, add, modify devices system using codes. Creating measurement series.
12. Analysis of data from available sensors and data from the database on an edge or mobile device. Development of a control and measurement system.
13. Analysis of patterns in real time based on data from available sensors and archived data from the database on the device.
14. Security analysis of the developed distributed system using network analyzers.
15. Performance analysis of the distributed control and measurement system.

Teaching methods

1. Lecture: presentation of creating a control and measurement system based on mobile and cloud technologies, multimedia presentation illustrated with literature data and sample projects
2. Laboratory classes: the use of a database system, framework for Internet applications, environments for mobile and cloud applications
3. Both forms of instruction offer the opportunity to incorporate elements of Problem-Based Learning (PBL), in which students work on problems and projects defined for the research and technical needs of the course coordinator and supervised by the instructor. This approach places particular emphasis on the iterative nature of work, encompassing problem analysis, solution design, practical verification, and systematic refinement.

Bibliography

Basic
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2. PHP i MySQL : dynamiczne strony WWW, Larry Ullman, 2019
3. PHP, MySQL i JavaScript : wprowadzenie, Robin Nixon, 2019
4. Programowanie w języku Kotlin : the Big Nerd Ranch guide, Josh Skeen, David Greenhalgh, 2019
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Breakdown of average student's workload

	Hours	ECTS
Total workload	105	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	1,50