Information Systems in Industry

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Course Description:

This course introduces students to the principles of SCADA, HMI and PLC for industrial automation and smart electric power applications. Upon completion of the course, the students are expected to be able to design SCADA-based control systems for industrial processes. The topics to be covered include SCADA and HMI architecture and protocols, architecture of PLC, PLC programming, automated electric drive, industrial automation and control systems and instrumentation. The theoretical classes are combined with lab experiences. The students are expected to take part in the development and implementation of industrial automation systems on the basis of PLCs, and SCADA. Students have the opportunity to participate in international conferences and research projects supported by Russian companies. Research results could be disseminated through the papers published in Scopus-indexed international journals.

Course Prerequisite: None

Course Policies:

1. *Assessment:* Students will be assessed through tests, papers, labs, projects, quizzes and participation.
2. *Plagiarism:* Submitting plagiarized work is prohibited
3. *Lecture participation:* Students are required to actively participate in learning process and are responsible for all the assigned readings. It is recommended that students complete each reading and assignment prior to the corresponding class.
4. *Lab participation:* Students are required to participate in all labs. Attending less than 80% of the labs means an automatic failure of the course.
5. *Cell phones:* Cell phones must be kept out of sight, and the ringer turned off at all times.
6. *Changes:* All changes will be announced in class

Course Evaluation:

Exams – 60%
Labs – 20%
Assignments – 10%
Recitation – 10%

Course Grading Scale:

100 – 95.0% 5
75.0 – 94.9% 4
60.0 – 74.9% 3

Learning outcomes:

Upon completion of the course, a student will:

a) know:

- the fundamental elements of HMI and SCADA systems;
- the most common SCADA systems;
- methods of connecting controllers to SCADA;
- the specifics of various SCADA industrial application;

b) be able to (SWBAT):

- design and implement SCADA-based industrial automation systems;
- use high-performance computing for analysis and modeling in engineering;
- use appropriate technical terminology;
- describe basic power system instrumentation technologies

Scope and types of study, the content of the discipline

The course is worth 5 ECTS or 180 hours which include 16 hours of lectures, 32 hours of the supervised laboratory classes, 16 hours of the supervised practical classes (worshops - WS), 116 hours of lab self-study.

Contents of the discipline, the types of instructional activities and workload

Section number	Name of the sections	Workload according to the types of instructional activities (hours)			
		total	L lectures	WS workshops	LC lab classes
1	Introduction. HMI and SCADA fundamentals.		4	-	-
2	User interface in HMI and SCADA. Basics of engineering.		2	4	6
3	Connection of industrial automation devices and electric drives with SCADA		2	4	18
4	SCADA- based industrial control systems		4	4	8
5	Distributed automation systems		4	4	-
Total		64	16	16	32

Contents of the sections, topics of the discipline

Section number	Name of sections	Contents of sections
1	Introduction	History of HMI and SCADA. How to design effective and robust industrial control systems. Definition of the term SCADA. General trends of SCADA development. SCADA-architecture and principles. SCADA software and hardware. SCADA alarm handling.
1	HMI and SCADA fundamentals	SCADA-system as a management process. Basic requirements. Functionality. Basic graphical capabilities. Technical and operating parameters.
2	User interface in HMI and SCADA	User interface. Basic terms and definitions. User access level. New technologies used for the user interface design
3	Connection of industrial automation devices and electric drives to SCADA	COM technology. Interprocess communication methods. ActiveX objects. OPC servers. Built-in drivers. Communication with databases. DDE-exchange.
4	SCADA- based industrial control systems	SCADA for monitoring and control of continuous process. SCADA Industrial applications: case study
5	Distributed automation systems	The ideology of distributed systems. The levels of ACS: level of controller, the operational level, the administrative level. Data line.
5	Distributed automation systems	The data interchange via GSM: interchange according to the GSM requirements to modems. Management via the Internet. Access to the project via the Internet.

Contents of the workshops

Number of WS	Section number	Contents of the workshop	Workload (hours)
1	2	Foundations of design of simple user interface. Development of software, graphic primitive.	4
2	3	Testing of connection between industrial automation equipment and SCADA using emulator.	4
3	4	Application of SCADA in continuous process control systems.	4
4	5	Access to the executive SCADA project via the Internet	4

Contents of the laboratory practical classes

Number LC	Section number	Title of the laboratory work	Workload (hours)
1	2	Engineering of SCADA-based user interface (on the basis of TRACE MODE)	6
2	3	Connecting the PLCs to SCADA-system via built-in drivers (on the basis of TRACE MODE and Siemens S7-1200, Omron CPM2A, Schneider Electric M241)	6
3	3	Connecting the PLCs to SCADA-system via the third-party OPC-server (on the basis of TRACE MODE, OPC-Server KEPWare and PLCs Siemens S7-1200, Omron CPM2A, Schneider Electric M241)	6
4	3	Connecting industrial automation equipment to SCADA-system via built-in drivers and third-party OPC-server (on the basis of TRACE MODE, OPC-Server KEPWare and electric drives and process controller)	6
5	4	SCADA-based process monitoring and control	8