SYLLABUS

Name: ***Visualization and control systems (PBL) (AESAu-E>SI6M-VPBL24)***
Name in Polish:
Name in English: ***Visualization and control systems (PBL)***

Information on course:

Course offered by department: Faculty of Automatic Control, Electronics and Computer Science
Course for department: Silesian University of Technology

Default type of course examination report:

ZAL

Language:

English

Course homepage:

https://platforma.polsl.pl/rau3/course/view.php?id=80339

Short description:

The aim of the course is to teach the attendants comprehensive approach to the design of industrial control systems based on PLC systems working together with HMI/SCADA visualization systems.

Description:

Students are supposed to have theoretical background in the field of fundamentals of digital circuits and assembler languages programming. This means the ability to practically apply knowledge from the following subjects: Theory of Logic Circuits, Computer Programming, Digital Circuits, Measurement Systems, Electronic Devices and Circuits, Peripheral Devices of Digital Systems, Microprocessors Systems, Programmable Logic Controllers

As part of the course, students will complete projects of varying difficulty that will consist of PLC controller software and the creation of a visualization that will reflect the object being programmed.

Repetition with PLC: Actuators and sensors, Signal modules of the PLC, Introduction to PLC languages: Ladder logic (LD), Elements with memory, Timers and counters, Variable types used in PLCs, Comparators, Arithmetic operations, Analog signal processing. New: Data blocks and data registration, PLC diagnostics, Tasks of HMI systems, Basics of industrial networks, Connections between PLC and HMI, Defining and parametrization of the HMI tags, Buttons, switches and indicators, I/O fields, Graphic controls – bar graphs and charts, Screen objects animation, Handling of alarms and events, Users and passwords, Archives of variables and messages.

After introducing new elements, partly related to the extension of issues related to the use of PLC controllers, and partly to the configuration and use of HMI (Human Machine Interface) systems, classes will be conducted in the form of multi-person project issues. Each issue requires the creation of a control program, as well as visualization, and their integration. The result of each project is a report consisting of a description of the problem, a description of the path(s) to write the program, a presentation of the program together with its description, and a presentation of the visualization system. Each completed project will be demonstrated to the instructor.

The number of hours of classes with direct participation of academic teachers or other persons teaching courses and students.
Contact hours:
Project: 75h
Student's own work:
Familiarization with the object simulator available in the laboratory: 15h
Preparation for working with PLC and HMI in laboratory: 15h
Working on the PLC controller software in accordance with the assumptions for a specific object simulator: 20h
Working on the HMI panel configuration: 15h
Laboratory reports: 10h
Total workload: 150h

Number of ECTS credits: 6

Bibliography:

1. SIMATIC S7-1200 Programmable Controller. System Manual. Siemens AG, 2021
2. SIMATIC S7-1200 Easy Book Manual. Siemens AG, 2012
3. SIMATIC S7-1500 Getting Started. Siemens AG, 2013
4. Programming Guideline for S7-1200/S7-1500. Siemens AG, 2013
5.SIMATIC WinCC Advanced V14.0 SP1 System Manual. Siemens AG, 2017
6. SIMATIC HMI HMI devices Comfort Panels Operating Instructions. Siemens AG 2022
7. John K-H, Tiegelkamp M.: IEC 61131-3: Programming Industrial Automation Systems, Springer-Verlag, Berlin Heidelberg, 2001
8. Bolton W.: Programmable Logic Controllers. (4th edition) Elsevier Newness. 2006
9. Tom Mejer Antonsen: Collection of Exercises for PLC Programming. 100 programming exercises from beginner to expert level. Books on Demand, 2023
10. Tom Mejer Antonsen: PLC Controls with Ladder Diagram (LD). Books on Demand, 2021
11. Tom Mejer Antonsen: PLC Controls with Structured Text (ST). Books on Demand, 2020
12. Liam Bee: PLC and HMI Development with Siemens TIA Portal. PACKT PUB, 2022

Learning outcomes:

At the completion of the course, students:
1. knowledge and comprehension of the architecture, functioning and programming of PLC in automatic systems (K1A_W10, K1A_W11)
2. knowledge and comprehension of the architecture, functioning and configuring of HMI in automatic systems (K1A_W10, K1A_W11)
3. are able to use programming tools to create own PLC applications (K1A_U2, K1A_U4, K1A_U6, K1A_U8, K1A_U10)
4. are able to use programming tools to create own HMI configurations (K1A_U2, K1A_U5, K1A_U6, K1A_U8, K1A_U14)
5. can analyze properties of selected control systems based on PLC and HMI, analyze their impact on the system's operation and modify them when necessary. (K1A_U8, K1A_U14, K1A_K1)
6. can set parameters of a PLC and HMI system to achieve a given objective, analyze their impact on the system's operation and modify them when necessary.(K1A_U8, K1A_U10, K1A_K1)

Assessment methods and assessment criteria:

The final grade will be determined primarily based on grades given by the instructor for reports that will be required for each project. An additional element that may positively or negatively affect the final grade will be the assessment of each student's involvement in the process of creating a program for the PLC controller and configuring the HMI panel. On this basis, the average of points obtained for all project exercises is calculated, according to the following rules:
[3.00 - 3.25) - 3.0
[3.25 - 3.75) - 3.5
[3.75 - 4.25) - 4.0
[4.25 - 4.75) - 4.5
[4.75 - 5.00] - 5.0

The syllabus is valid from the 2024/25 academic year, and its content cannot be changed during the semester.

Course credits in various terms:

<without a specific program>

Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	6	2024/2025-Z	