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Innovative Teaching Approaches in development of Software Designed Instrumentation and its application in real-time systems, Erasmus+ KA2 2018-1-RS01-KA203-000432

Description of an Individual Course Unit

Study program	Electrical Engineering and Computing		
Module			
Type and level of studies	bachelor academic studies		
Course title	Practicum of measurement and data acquisition systems		
Professor (for lectures)	Janković Milica		
Professor/assistant (for practice)	Barjaktarović Marko, Janković Milica, Novičić Marija, Atanasijević Petar		
Professor/assistant (for LAB)	Barjaktarović Marko, Janković Milica, Novičić Marija, Atanasijević Petar		
Number of ECTS	3	**Type of the course (mandatory/elective)**	elective
Condition	none		
The goal	Introduce students to the basics of data acquisition and real-time programming using commercial as well as open source software and hardware.		
The outcome	At the end of the course, students should be able to independently design software-designed instrumentation for measurement and control as well as modular, stand-alone interface for real-time data acquisition and processing.		
Course Contents			
Theoretical contents	Basic principles of software-designed instrumentation. Introduction to Labview environment. Data flow programming and debugging. Modularity. Synchronization techniques. File I/O techniques. Error handling. Code optimization. Basics of image acquisition: setting up Field of View, exposure time, triggering, camera calibration. Arduino-based instrumentation. Introduction to Python programming.		

Practical part (practices, LAB, study research work)	Introduction to Labview environment. Using While, For, Case and Event structures. Data structures. Data acquisition and signal generation. Modularity. Data visualization. File I/O. Sequential programming vs. machine state. Parallel loops. Advanced programming techniques. Creating a stand-alone application. Image acquisition and processing. Introduction to Arduino platform. Arduino examples of data acquisition systems. Serial port and using interrupts. Spyder environment. Graphical user interface in Python. Arduino-Python integration.
Literature	
1	M. Janković, M. Barjaktarović, M. Novičić, P. Atanasijević, "Practicum of measurement and data acquisition systems", University of Belgrade, School of Electrical Engineering, 2019. [in Serbian]
2	Labview Core 1&2 Participant Guide, National Instruments, November 2014
3	Kye-Si Kwon and Steven Ready, "Practical Guide to Machine Vision Software - An Introduction with LabVIEW", Wiley-VCH Verlag GmbH & Co. KGaA, Germany, 2015.
4	Jeremy Blum, "Exploring Arduino: Tools and Techniques for Engineering Wizardry", John Wiley&Sons Inc, Indiana, 2013.
5	Vernon L. Ceder, "The Quick Python Book", Manning Publications Co, United Kingdom, 2010.

Weekly number of classes during the semester/trimester/school year

Lectures	Practices	LAB	Study research work	Other activities
0	15	30	0	0

Teaching Methods	After explaining the theoretical principles and illustration through the examples (practice), students have the opportunity to apply new knowledge by working the appropriate exercises (labwork). Video materials of lectures [in Serbian] are available on ITASDI Youtube channel (playlist name is “IO14-Praktikum iz merno-akvizicionih sistema”).

Grading methods (max. number of points is 100)

Pre-exam assesments	points	Final examination	points
activity during lectures	0	written exam	45
practical assesments	0	oral exam	
mid-term exams	10		
seminars	45		
projects			