

Real-time systems - course description

General information	
Course name	Real-time systems
Course ID	11.3-WE-AutP-RTS-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Automatic Control and Robotics
Education profile	academic
Level of studies	First-cycle Erasmus programme
Beginning semester	winter term 2022/2023

Course information	
Semester	6
ECTS credits to win	3
Course type	obligatory
Teaching language	english
Author of syllabus	<ul style="list-style-type: none">dr inż. Robert Szulim

Classes forms					
The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	15	1	-	-	Exam
Laboratory	30	2	-	-	Credit with grade

Aim of the course

To familiarize with the basics of design and operation of real-time systems.

To shape basic skills in the use of selected information technologies used in real-time systems.

Prerequisites

Computer systems architecture, Operating systems and computer networks I i II.

Scope

Real-time systems fundamentals: Real-time system definition. Features and basic properties of real-time systems. RT systems architectures. Universal model of RT system.

Real-time operating systems. RTOS system classification. Ideas of RT operating systems construction. POSIX norm. Examples of RT operating systems.

Concurrent processing in real time applications. The use of threads in the application of real time. Basic thread operations such as thread creation, starting and stopping, parameter passing and priority control. Exchange data between threads and synchronizing access to shared resources. Programmable synchronization techniques such as semaphores, mutexes, and monitors. Pathologies of concurrent processing: race, deadlock and starvation.

The use of communication interfaces to communicate with the other devices and systems in real time. The issue of using blocking operations in receiving data and their impact on meeting a specific time limit.

Periodical program execution routines - timers. Features of timers, implementation, time dependencies and differences comparing to threads.

Issues of integration of real time systems with Internet resources and database systems.

Problems of building a graphical user interface in real-time systems.

Teaching methods

Lecture, laboratory exercises, team work, project.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Is aware of the importance of real-time systems in applications in the area of automatics and robotics		<ul style="list-style-type: none">an examination test with score scale	<ul style="list-style-type: none">Lecture
Can use concurrent programming techniques and communication interfaces used in simple soft real-time systems		<ul style="list-style-type: none">a quizan oral response	<ul style="list-style-type: none">Laboratory
Has the basic knowledge in the area of the construction and operation of real-time systems		<ul style="list-style-type: none">an examination test with score scale	<ul style="list-style-type: none">Lecture
Can design and start simple soft real-time systems		<ul style="list-style-type: none">a quizan oral response	<ul style="list-style-type: none">Laboratory

Assignment conditions

Lecture – the main condition to get a pass are sufficient marks in written or oral tests conducted at least once per semester.

Laboratory – the condition of passing is obtaining positive grades from all laboratory subjects according to the program of the laboratory.

Calculation of the final grade: lecture 50% + laboratory 50%

Recommended reading

1. Chang A.M.K.: Real-time systems. Scheduling, Analysis and Verification. Wiley&Sons, 2005.
2. Li Q.: Real-time Concepts for Embedded Systems. CMP Books, 2006.
3. Liu W.S.:Real-time systems. Wiley&Sons, 2005

Further reading

1. Wei L., Matthews C., Parziale L., Rosselot N., Davis C., Forrester J., Britt D., TCP/IP Tutorial and Technical Overview, An IBM Redbooks publication, 2006
2. Ullman Jeffrey D., Widom Jennifer, A First Course in Database Systems, Pearson Prentice Hall, 2008
3. Carver R., Tai K.: Modern multithreading, Wiley Publications, 2006

Notes

Modified by dr hab. inż. Wojciech Paszke, prof. UZ (last modification: 11-04-2022 09:05)

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