GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Embedded Systems Development Technology, PG_00069755		
Field of study	Informatics, Electronics and Telecommunications, Biomedical Engineering, Biomedical Engineering, Biomedical Engineering, Space and Satellite Technologies, Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Metrology and Electronic Systems Department -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Andrzej Kwiatkowski	
	Teachers	dr inż. Andrzej Kwiatkowski	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	15.0	0.0	45

E-learning hours included: 0.0

eNauczanie source addresses:

Moodle ID: 46689 Technika Rozbudowy Systemów Wbudowanych - 25/26
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=46689

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	45	3.0	27.0	75

Subject objectives

Lecture: Presentation of knowledge about the construction and testing of embedded system, with particular emphasis on service attached peripherals.

Laboratory: Learning practical skills of the use and testing of embedded systems by training service selected peripheral devices attached to the system.

Project: Familiarization with all stages of the implementation of the embedded system, according to external user demand, including elements of the programming, design and implementation of hardware and comprehensive testing equipment.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W03] knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	The student knows the principle of operation of selected peripheral systems and their communication interfaces. Student is able to present how to use an information obtained from selected sensors (eg temperature, pressure, accelerometers, gyroscopes and magnetometers). Student knows the structure of memory card interfaces and liquid crystal displays and he can use them in embedded systems.	[SW1] Assessment of factual knowledge
	[K7_U04] can apply knowledge of programming methods and techniques as well as select and apply appropriate programming methods and tools in computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, making assessment and critical analysis of the prepared software as well as a synthesis and creative interpretation of information presented with it	The student knows how to create and use existing software libraries allowing to use peripheral devices and integrated circuits connected to embedded systems through the common communication interfaces. The student uses software tools available in integrated development environments to debug the created program.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
	[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	The student can design and develop an embedded system by attaching sensors to it (including accelerometers, gyroscopes, pressure and magnetic field sensors). He uses a technical documentation provided by manufacturers of the system components . He can configure the embedded system according to the applications and needs. He can realize the user interface in the form of display and keyboard. The student can equip the emedded systems into the network interface based on communication modules or dedicated integrated circuits.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools

<table>
<tr><td>Subject contents</td><td>Course content – lecture
1. Communication Interfaces
1.1. I2C interface - software of embedded controller - Error Handling
1.2. I2C interface - software emulation od I2C - restrictions
1.3. SPI / SMI - controller built in a MCU - software
1.4. RS232 interface (UART) as an debug interface
1.5. USB (Host, Device OTG)
2. Human Machine Interface
2.1. Functionality of graphic display controller - initialization procedure, the use of windows, types of interfaces
2.2. TFT graphic display with integrated controller - parallel interface
2.3. TFT graphic display with integrated controller - SPI interface
2.4. Keyboard support - interrupt, polling, dedicated driver
2.5. Joystick, rotary encoder (software and hardware service)
2.6. Touch Screen - types, how to handle
3. Selected sensors used in the embedded systems
3.1. Temperature sensors
3.2. Accelerometers (types, interfaces, methods of use)
3.3. Fingerprint readers
3.4. Magnetic field and pressure sensors
4. Communication modules and memory devices
4.1. The types of memory cards (SD, CF) and their interfaces
4.2. Ethernet communication modules
4.3. Wireless communication modules
5. Other
5.1. ESD protection
Course content – laboratory
1. Using the I2C bus: A case study of a GPIO port expander and an RTC real-time clock.
2. Graphical LCD display with serial (SPI) and parallel interfaces.
3. User interface systems (keyboard, joystick, rotary encoder).
4. Using an accelerometer and magnetic field sensor in embedded systems.
5. Using memory cards in embadded systems.
Course content – project
Completion of a project assignment on the topics covered in the lecture and laboratory parts.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basic knowledge of programming in C, with particular emphasis on bit and text string operation. Basic knowledge of the structure and operation of digital systems.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>Laboratory</td><td>50.0%</td><td>30.0%</td></tr><tr><td>Lecture</td><td>50.0%</td><td>40.0%</td></tr><tr><td>Project</td><td>50.0%</td><td>30.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>Lecture materials. Datasheets of modules and integrated circuits presented during a lecture.</td></tr><tr><td>Supplementary literature</td><td>1. Industry magazines for the electronics and embedded systems.
2. Websites of microcontrollers and peripherals devices manufacturers.</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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