



Subject card

Subject name and code	Internet of Things platforms in medical applications, PG_00053360						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	February 2025	Academic year of realisation of subject			2024/2025		
Education level	second-cycle studies	Subject group			Optional subject group Specialty subject group Subject group related to scientific research in the field of study		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	1	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Metrology and Optoelectronics -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Grzegorz Lentka					
	Teachers	dr hab. inż. Grzegorz Lentka dr inż. Michał Rycewicz					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	E-learning hours included: 0.0						
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	30	5.0		40.0		75
Subject objectives	Getting familiar with architectures of the hardware platforms used in Internet of Things (IoT) systems especially dedicated to medical applications, data processing units classification, communication interfaces, methods and components for data storage, wired and wireless communication methods for clouds, sensors and actuators service methods, software and hardware assisted information protection as well as examples of hardware platforms with different processing capability.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W04] knows and understands, to an increased extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or other elements or programmable devices specific to the field of study, and organization of work of systems using computers or such devices	Knows data processing units and selects suitable one depending on required processing power. Knows and can apply communication modules, data storage components as well as sensor and actuators devices.			[SW1] Assessment of factual knowledge		
	[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	Student configures and programs system consisting of sensors and processing units able to store the data in the cloud.			[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools		

Subject contents	<ul style="list-style-type: none"> • Introduction, basic terminology, definitions, IoT importance; • Architecture of IoT devices and systems; • Data processing units classification (microcontrollers, microprocessors, SoC, SBC); • Communication interfaces used in IoT; • Data processing and storage; • Mobility (communication over Ethernet, LoRa, LoRaWAN, IoT gateway); • Sensor servicing; • Hardware constructions used for prototyping (SoC, SoM, SBC); • The overview of popular hardware platforms: • Small IoT modules based on microcontrollers; • Espressif modules dedicated for networking; • Single Board Computers (SBC) as a IoT platform; • Energy consumption reduction - special modes usage; • Data security in IoT; • Hardware modules aiding IoT security; 		
Prerequisites and co-requisites	Basic knowledge of digital circuits, microprocessors and microcontrollers and the C programming language.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Test during semester	50.0%	50.0%
	Lab exercises	50.0%	35.0%
	Activity/homeworks	0.0%	15.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Aamir Riaz: Inter-communicating things - IoTs, Pacific Radio-communication Workshop 2019 2. Stuart R. Ball, Embedded Microprocessor Systems: Real World Design, Third Edition 3. Arnold S. Berger, Embedded Systems Design: An Introduction to Processes, Tools and Techniques 4. John Catsoulis, Designing Embedded Hardware 5. Ken Arnold, Embedded Controller Hardware Design 6. Texas Instruments: Design a Cloud Connected IoT Gateway with Security Protection 7. D. Avelino (AWS): Connecting Buildings to a Smart World with IoT, Cloud Computing and Digital Ceiling 8. A. Karkare: Internet of Things: An Overview 9. Philips Semiconductors: AN10216-01 I2C MANUAL, 2003 10. NXP: UM10204: I2C-bus specification and user manual, 2014 11. Analog Devices: Introduction to SPI Interface, Analogue Dialog 2018 	
	Supplementary literature	<ol style="list-style-type: none"> 1. Ed Sutter, Embedded Systems Firmware Demystified 2. Michael Barr, Programming Embedded Systems in C and C ++ 3. Stuart R. Ball; Debugging Embedded Microprocessor Systems, 	
	eResources addresses	Adresy na platformie eNauzanie:	
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Using small microcontrollers for sensors servicing on the example of Arduino. 2. Small microcontrollers communication limits. 3. Espressif family communication modules used as IoT nodes. 4. Single Board Computers configuration (eg. Raspberry PI). 5. Prototyping platforms - using SoM and carrier-board. 		
Work placement	Not applicable		

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