GDAŃSK UNIVERSITY OF TECHNOLOGY

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 2024	Academic year of realisation of subject	2023/2024
Education level	second-cycle studies	Subject group	Optional 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 inż. Michał Rycewicz dr hab. inż. Grzegorz Lentka	

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 do 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_U06] can analyse the operation of components, circuits and systems related to the field of study; measure their parameters; examine technical specifications; interpret obtained results and draw conclusions	Student chooses and configures hardware platform depending on application area. Selects communication interface with required transfer rate on the basis of volume of data to be transferred.	[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
[K7_W06] Knows and understands, to an increased extent, the basic processes taking place in the life cycle of devices, facilities and technical systems.	Knows different architectures of IoT systems, points out the differences, can indicate components important from the point of medical application range, understands the importance of information protection anad access authorisation.	[SW1] Assessment of factual knowledge
[K7_U07] can apply advanced methods of process and function support, specific to the field of study	Uses tools for desiging and configuration dedicated for selected hardware platform or hardware components.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
[K7_W04] Knows and understands, to an advanced extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, and organisation 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.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment

Subject contents

- Introduction, basic terminology, definitons, 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 if popular hardware platforms:
- Small IoT modules based on microcontrollers;
- Esperssif 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	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	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 eNauczanie: Platformy Internet of Things w zastosowaniach medycznych 2023/2024 - Moodle ID: 33116 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33116
Example issues/ example questions/ tasks being completed	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 carier-board.	
Work placement	Not applicable	