GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Telemedicine and Mobile Applications, PG_00068239		
Field of study	Biomedical Engineering		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2028/2029
Education level	first-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	4	Language of instruction	Polish
Semester of study	7	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Biomedical Engineering -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Mariusz Kaczmarek	
	Teachers	dr hab. inż. Mariusz Kaczmarek	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	15.0	0.0	0.0	45

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	45	3.0	27.0	75

Subject objectives

The aim of the course is to acquaint students with selected techniques and standards used in telemedicine as well as to develop gained to date knowledge of software programming to mobile devices, smartphone. An important objective is to show the specific need to ensure the integrity and safety of the analyzed and transmitted data. It is assumed that the reported content of education in this subject should encourage self-awareness utilizing available within the subject elements of distance education.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W51] Knows and understands, to an advanced extent, selected aspects of biomedical diagnostics and human anatomy and physiology, constituting general knowledge related to the field of study	Is able to select an appropriate sensor (e.g. pressure, flow, electrochemical) for measuring a selected biological parameter based on the basics of physiology and justify their choice, equip it with a selected remote communication interface. Is able to implement a simple mobile application in a selected language for collecting measurements of physiological signals.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K6_W03] knows and understands, to an advanced 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	He can propose a hardware specification for a given set of issues.	[SU5] Assessment of ability to present the results of task
[K6_U07] can apply methods of process and function support, specific to the field of study	He can perform the risk analysis software solution and hardware.	[SW2] Assessment of knowledge contained in presentation [SU3] Assessment of ability to use knowledge gained from the subject

Subject contents	Course content – lecture 1. Introduction to telemedicine Definition and scope of telemedicine (teleradiology, teleconsultations, telemonitoring) Overview of telemedicine system architecture End-to-end encryption, TLS, VPN, Authorization and authentication (OAuth2, JWT) 2. Data acquisition from medical devices Communication standards and interfaces (wired, wireless, serial, parallel) Bluetooth LE (GATT), NFC, Wi-Fi Direct Integration with sensors: pulse oximeter, glucometer, blood pressure monitor Bluetooth permissions and profiles management in Android/iOS 3. Teleconsultations and teleconsultations Examples of applications in dermatology, ophthalmology, otolaryngology Integration of teleconsultations with EHR/EMR, documentation and billing 4. Remote monitoring of chronically ill patients Architecture of RPM systems (remote patient monitoring): gateway, cloud, dashboard Examples of metrics: CPAP, pulse oximetry, glucose monitoring, blood pressure Alert and escalation algorithms from SMS notifications to medical team intervention 5. Tele-ICU and remote support for high-security units Central monitoring stations and data consolidation from multiple beds Automated early warning systems (EWS) and analysis of physiological trends 6. Teletriage and artificial intelligence in initial patient assessment Medical chatbots and symptom checkers architecture, NLP, safety constraints Integration of teletriage results with EMS and hospital admission systems 7. Trends and the future of telemedicine Telesurgery and remotely controlled robots VR/AR in remote training and therapy Blockchain in medical history management 8. Architecture of mobile applications in telemedicine Front-end (e.g. Flutter/React Native) vs. back-end (Node.js, Python/Django) Design patterns (MVC, MVVM) Offline first, data synchronization 9. Data processing and visualization in the application Local storage (SQLite, Realm) vs. cloud (Firebase, AWS) Alerts and push notifications (FCM, APNs) 10. Algorithms in mobile applications Simple signal analysis methods (digital filters, peak detection) Introduction to edge computing: TensorFlow Lite, Core ML 11. Module 8: UX/UI in medical applications Principles of designing interfaces for medical users (seniors, staff) Accessibility (contrast, text scalability, VoiceOver/ TalkBack) Prototyping LABORATORY: Exercise 1: Interactive websites for preventive and screening tests Exercise 2: Monitoring and processing vital signs Exercise 3: Programming mobile devices running Android - part 1 Exercise 4: Programming mobile devices running Android - part 2 Exercise 5: Compression, coding and transmission of diagnostic signals in mobile devices
Prerequisites and co-requisites	Programming methods and techniques: ability to program in at least one of the following languages: JAVA, Python, C# or Matlab/Octave Image processing basics:Image acquisition and representation model 1. Pixel operations 2. Image quality improvement techniques 3. Geometry processing Biomeasurements: 1. Measurement and representation of data in infrared thermal studies 2. ECG basics Development of web applications in medicine: 1. Standards for transmitting medical information 2. Standards in maintaining medical records
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory Ex.	51.0%	60.0%
Test 2	0.0%	20.0%
Test 1	0.0%	20.0%

Recommended reading	Basic literature	1. Systemy komputerowe i teleinformatyczne w służbie zdrowia, BiIB2000, Tom 7, Exit 2002 2. **Inżynieria biomedyczna. Podstawy i zastosowania. Tom1-9: Wydawnictwo** Exit, 2021 3. Subject materials developed in the form of distance learning, access:: http:/eNauczanie.pg.edu.pl 4. Articles from the database: IEEE Xplore
	Supplementary literature	1. Grażyna Szpor, Marek Świerczyński, Irena Lipowicz (red.), **Telemedycyna i e-Zdrowie. Prawo i informatyka,** Wolters Kluwer Polska, Warszawa 2019, ISBN 978-83-8160-322-5
	eResources addresses	Supplementary https://www.osoz.pl - Kamsoft S.A.
Example issues/ example questions/ tasks being completed		
Practical activites within the subject	Not applicable	

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