COURSE DESCRIPTION CARD - SYLLABUS

Course name
Augmented reality in biomedical engineering [S2IBio1-BiIW>RRwIB]

Course

Field of study
Biomedical Engineering

Year/Semester
1/2

Area of study (specialization)
Bionics and Virtual Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Knowledge in scope of information technologies, computer graphics and engineering drawing, CAD systems. Understands notion of design and prototyping. Knows basic notions of medical diagnostics, rehabilitation and therapy. Skills in development of solid 3D model of an object and an assembly in a CAD 3D system. Skills in processing data from medical imaging. Social competences: student is open to implementation of modern computer technologies in design process, as well as in diagnostics and therapy. Can self-develop new skills and knowledge. Can cooperate in a project team.

Course objective

Getting familiarized with rules and methods of use of Augmented Reality (AR) and Mixed Reality (MR) systems in biomedical engineering and medicine. Gaining skills of designing simple AR application in biomedical engineering.

Course-related learning outcomes

Knowledge:
1. Student defines, distinguishes and classifies concepts of Augmented and Mixed Reality.
2. Student describes methods of geometrical modelling, transformation and object visualization for

presentation in AR systems.
3. Student has knowledge about AR systems: projection and interaction, as well as available software classes for AR application creation.
4. Student has knowledge on possibilities of use of AR/MR techniques in daily work of a biomedical engineer, by a doctor and a patient during a therapy or rehabilitation.

Skills:
1. Student can develop 3D and 2D data for interactive AR applications for use in medicine and biomedical engineering.
2. Student can design a simple interactive AR application used in biomedical engineering and medicine.
3. Student can analyze economical aspects of AR solutions in biomedical engineering.

Social competences:
1. Student is aware of consequences of use of computer systems in public life.
2. Student is open to application of AR and MR technology in biomedical engineering and medicine.
3. Student can work in a project team using AR systems for aiding engineering and medical processes.
4. Student can appropriately present advantages and disadvantages of AR use in biomedical engineering and medicine.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Partial marks:
a) lectures:
- on the basis of answers to questions regarding material from previous lectures,
b) laboratories:
- on the basis of evaluation of current advancement in realization of given tasks,
Summary mark:
a) lectures:
- evaluation of knowledge by written exam with open and closed questions, the test is passed when a student obtains 51% or more score, test results are discussed. The test is performed at the end of the semester.
b) laboratories:
- evaluation of reports of realization of laboratory exercises or realization of own project of AR application in production engineering

Programme content

Lectures:
1. Virtual technologies: Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR) - basic definitions and concepts.
2. Place of virtual technologies in modern medicine and biomedical engineering.
3. AR and MR systems - hardware and software
4. Methodology of aiding processes of design and prototyping of medical products using AR and MR
5. Methodology of aiding diagnostics, therapy and rehabilitation using AR and MR.
Laboratory:
1. Structure, operation and programming of modern AR and MR devices.
2. Creating simple interactive applications for use in medicine and biomedical engineering
4. Implementation and practical verification of created applications using selected AR/MR devices.

Course topics

none

Teaching methods

- informative lecture
- multimedia presentation
- case study
- laboratory method

Bibliography

Basic
1. S. Aukstakalnis, Practical Augmented Reality, Addison-Wesley Professional, 2016
2. R. Riener, M. Harders, Virtual Reality in Medicine, Springer, 2012
Additional
F. Górski, Metodyka budowy otwartych systemów rzeczywistości wirtualnej: zastosowanie w inżynierii mechanicznej, Wyd. Politechniki Poznańskiej, 2019
B. Arnaldi, P. Guitton, G. Moreau,Virtual Reality and Augmented Reality: Myths and Realities, Wiley, 2018

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	32	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	43	1,50