COURSE DESCRIPTION CARD - SYLLABUS

Course name
Virtual and augmented reality [S1Cybez1>WiRR]

Course

Field of study
Cybersecurity

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
24

Laboratory classes
24

Other
0

Tutorials
0

Projects/seminars
24

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

Has basic knowledge of image and sound acquisition, processing, compression, transmission and presentation. Has knowledge of programming in C++ and Python.

Course objective

Learning about immersive media, virtual reality systems, and augmented reality. Learning about technical solutions for the aforementioned systems. Preparing your own implementations of selected elements of the discussed systems and their integration with existing systems.

Course-related learning outcomes

Knowledge:
K1_W04 Has advanced knowledge of the principles of creating computer programs, the structures of programming languages, their levels and the algorithms used; has advanced knowledge of software engineering
K1_W06 Has detailed knowledge of the construction of electronic digital systems, including programmable digital systems; has in-depth knowledge of the construction of computers and their components; knows and understands the phenomena and mechanisms used in them

K1_W019 Knows and understands the threats to which modern civilization is exposed, which uses digital services on a mass scale; is familiar with the latest development trends related to the field of study

Skills:
K1_U06 When formulating engineering tasks, is able to make a preliminary economic assessment of the design, implementation, configuration and maintenance of software and systems that meet cybersecurity and privacy requirements
K1_U11 Based on technical documentation, applicable standards, using appropriate methods, tools and elements, is able to build, configure and launch a typical computer system or network that meets cybersecurity requirements
K1_U15 Is able to plan and organize individual and team work (including developing and implementing a work schedule that ensures meeting the deadline), applies occupational health and safety principles, and is able to work in interdisciplinary teams

Social competences:
K1_K01 Understands the importance of improving professional, personal and social competences; is aware that knowledge and skills in the area of cybersecurity are rapidly evolving
K1_K02 Understands the importance of knowledge in solving problems in the area of cybersecurity; is aware of the need to use expert knowledge when solving engineering tasks in a scope beyond one's own competences

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: written or oral exam, open-ended questions, with expected descriptive answers. Issues required to master are made available during lectures.
Laboratory: reports from thematically uniform blocks of laboratory exercises.
In each form of the course assessment, the grade depends on the number of points the student earns relative to the maximum number of required points. Earning at least 50% of the possible points is a prerequisite for passing. The relationship between the grade and the number of points is defined by the Study Regulations. Additionally, the course completion rules and the exact passing thresholds will be communicated to students at the beginning of the semester through the university’s electronic systems and during the first class meeting (in each form of classes).

Programme content

1. Introduction
2. Technical Aspects
3. Applications
4. Cybersecurity in VR and AR
5. Workshops and Demonstrations (Labs)
6. The Future of VR and AR

Course topics

• Definitions, history: Presentation of a brief history of the development of these technologies, from the first concepts to the current state.
• Types, hardware and software: Presentation of popular VR (goggles, controllers) and AR (smartphones, tablets, AR glasses) devices and software used to create VR/AR applications.
• Motion tracking: Discussion of different methods of tracking motion (e.g. sensors, cameras).
• 3D graphics rendering: Explanation of how 3D graphics are generated and what optimization techniques are used.
• Human-computer interaction: Presentation of ways of interacting with the virtual environment (e.g. controllers, gestures, voice).
• VR content compression: Image (MPEG immersive video), sound (MPEG-I Immersive audio)
• Games and entertainment: Discussion of applications in computer games, simulators, amusement parks.
• Education and training: Presentation of examples of use in education (e.g. virtual tours, interactive models) and training (e.g. medical simulations, health and safety training).
• Medicine: Applications in diagnostics, treatment, rehabilitation, and training of medical personnel.

• Industry: Applications in design, production, maintenance, and quality control.
• Architecture and design: Visualization of architectural and interior designs.
• Data tracking and collection: Movements, facial expressions, location, biometrics. Identification and profiling. Social engineering attacks, phishing.
• Metaverse: Discuss specific cybersecurity threats in the Metaverse, which is a fusion of VR, AR, and the Internet. VR/AR environment manipulation: Attackers can manipulate the VR/AR environment to mislead, disorient, or frighten the user. Sensory data manipulation: Attackers can manipulate sensory data in VR to induce false sensations or responses in the user. Hardware and software security: Discuss security built into devices, such as data encryption, authorization, and access control.
• VR liability: Discuss liability for users' actions in the virtual environment. Legal Regulations Regarding Presentation of existing and planned legal regulations regarding.
• Practical experience: enabling students to test different devices and applications.
• Creating simple VR/AR applications: Introduction to tools and techniques for creating simple VR/AR applications.

Teaching methods

Lecture: written or oral exam, open-ended questions, with expected descriptive answers. Passing threshold: 50% of possible points. Issues required to master are made available during lectures.
Laboratory: reports from thematically uniform blocks of laboratory exercises.

Bibliography

Basic:
- Gauthier Lafruit, Mehrdad Teratani, "Virtual Reality and Light Field Immersive Video Technologies for Real-World Applications," Institution of Engineering and Technology, 2021.

Additional:
- Reinhard Klette, "Concise Computer Vision," Springer, 2014.

Breakdown of average student's workload

	Hours	ECTS
Total workload	132	5,00
Classes requiring direct contact with the teacher	72	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,00