



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Augmented reality in automatics [S2AiR2-ISAiR>PO1-RRZ]

### Course

Field of study

Automatic Control and Robotics

Year/Semester

1/2

Area of study (specialization)

Intelligent Control and Robotic Systems

Profile of study

general academic

Level of study

second-cycle

Course offered in

Polish

Form of study

full-time

Requirements

elective

### Number of hours

Lecture

15

Laboratory classes

30

Other

0

Tutorials

0

Projects/seminars

0

### Number of credit points

3,00

### Coordinators

dr inż. Janusz Pochmara

janusz.pochmara@put.poznan.pl

### Lecturers

### Prerequisites

The listener should have the basics of programming in C language. Computer use at the field of basic office packages and operating systems is a necessary IT minimum. Efficient use of the Internet and the basics of English will be very useful in using network resources.

### Course objective

The student will learn how to create industrial applications based on programming languages used to create applications for the needs of augmented reality (HTML 5, CSS, JavaScript). Will be able to intuitively use the 3D graphic interface in control processes. The individual steps are created on the basis of program blocks, which resemble folding program nothing from ready "bricks". In addition, students will be familiarized with the ideas of program operation on industrial PLC controllers in order to acquire data signals necessary for processing by created AR applications

### Course-related learning outcomes

Knowledge

K2\_W7 has advanced and in-depth knowledge of methods of analysis and design of control systems

K2\_W10 has ordered and in-depth knowledge within selected areas of robotics

K2\_W11 has ordered and in-depth knowledge related to control systems and control and measurement systems

Skills  
K2\_U9 student is able to simulate and analyze the operation of complex automation systems and plan and carry out experimental verification

K2\_U14 student can, when formulating and solving tasks involving the design of automation and robotics systems, see their non-technical aspects, including environmental, economic and legal

Social competences

K2\_K1 understanding the meaning and knows the possibilities of continuous training - the functions of competition, personal and social, can inspire and organize processes that are other people

K2\_K5 is ready to think and act in an entrepreneurial manner

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:

- Completion of laboratories / lecture test (35% participation in the final grade)
- Preparation of the project implemented in the work of a two-persons team (40%)
- Project presentation (25%)

To pass the course, it is necessary to obtain positive results from all components of the final grade. The following assessment scale and its characteristics were proposed in the formulation of the final grade:

- 5.0 - very good knowledge, skills and personal and social skills
- 4.5 - very good knowledge, good personal and social competence as well as skills
- 4.0 - good knowledge, good personal and social skills and competences
- 3.5 - satisfactory knowledge and skills, but medium personal and social competences
- 3.0 - satisfactory knowledge and skills, but poorly developed personal and social competences
- 2.0 - unsatisfactory knowledge, skills and personal and social skills

## Programme content

The program content of the lecture coincides with the content presented in the laboratory in the form of practical exercises during which the presented technologies are processed:

1. AR development review
  - a) AR functions and VR functions
  - b) AR Ready devices
  - c) Simple AR A-Frame and AR.js application
2. Creating a project and creating a project scene
  - a) Object grids and grid attributes
  - b) Adding text and animation to objects
  - c) Adding textures to objects
3. Adding AR.js to the application (laboratory - talk)
4. Work with Three.js
  - a) Creating a project
  - b) Handling primitives
5. Three.js overview and project configuration
  - a) Creating a basic scene
  - b) Creating a basic scene
6. Discovering different geometry meshes
7. Creating materials (laboratory - talk)
8. Creating Shaders (laboratory - talk)
9. Building an extensive AR application using Awe.js
10. Configuring, creating functions during loading
  - a) Model loading
  - b) Adding POIs, projections and events
11. Creating a scene description using conditional conditions (laboratory - discussion)
- 12 Embedding Last Box and creating Compatibility Error Message
- 13 Testing projects on mobile devices (telephone) cooperation with Siemens S7 1200 PLC devices
14. Implementing the AR.js and Awe.js applications in practice
  - a) AR internet applications in mobile browsers
  - b) remote work with the application

15. Building a project on a selected example - advertising application

a) Creating an AR business card with A-Frame and AR.js

b) Creating an AR histogram using Awe.js

16. Test

## Course topics

The program content of the lecture coincides with the content presented in the laboratory in the form of practical exercises during which the presented technologies are processed:

1. AR development review

a) AR functions and VR functions

b) AR Ready devices

c) Simple AR A-Frame and AR.js application

2. Creating a project and creating a project scene

a) Object grids and grid attributes

b) Adding text and animation to objects

c) Adding textures to objects

3. Adding AR.js to the application (laboratory - talk)

4. Work with Three.js

a) Creating a project

b) Handling primitives

5. Three.js overview and project configuration

a) Creating a basic scene

b) Creating a basic scene

6. Discovering different geometry meshes

7. Creating materials (laboratory - talk)

8. Creating Shaders (laboratory - talk)

9. Building an extensive AR application using Awe.js

10. Configuring, creating functions during loading

a) Model loading

b) Adding POIs, projections and events

11. Creating a scene description using conditional conditions (laboratory - discussion)

12 Embedding Last Box and creating Compatibility Error Message

13 Testing projects on mobile devices (telephone) cooperation with Siemens S7 1200 PLC devices

14. Implementing the AR.js and Awe.js applications in practice

a) AR internet applications in mobile browsers

b) remote work with the application

15. Building a project on a selected example - advertising application

a) Creating an AR business card with A-Frame and AR.js

b) Creating an AR histogram using Awe.js

16. Test

## Teaching methods

Teaching materials in the form of lectures and a script for laboratory exercises are placed in an electronic version on the website indicated by the teacher. The current address is given during the first class by the teacher. Lecture with multimedia presentations.

The implementation of b-learning opportunities under the subject is envisaged. Due to the specification of the subject, which is based on specialized knowledge, these materials will only have a repetitive character, which should better consolidate the listener's knowledge

## Bibliography

Basic

Augmented Reality: Principles and Practice by Dieter Schmalstieg, English | 2016 | ISBN: 0321883575 | 528 Pages, Addison-Wesley Professional; 1 edition

JavaScript i jQuery. Interaktywne strony WWW dla każdego. Podręcznik Front-End Developera, Jon Duckett, Wydawnictwo Helio

Additional

SIMATIC S7-1200, wyd. Siemens, 2010.

Materiały opublikowane przez firmę Siemens online [www.siemens.pl/PS7-1200](http://www.siemens.pl/PS7-1200), 2011

### Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00