



Life-long trainings



Content and implementation design

October 2021



Deliverable Lead: SATAEDU

Related Work Package: WP4: Trans-national vocational curricula and life-long training in the manufacturing sector with the special focus on Connectivity Devices and Services/CDS (IoT in smart manufacturing) that provides user-oriented, user-friendly and eco-friendly solutions (4.0/5.0)

Related Task: 4.3 Life-long trainings, content and implementation design

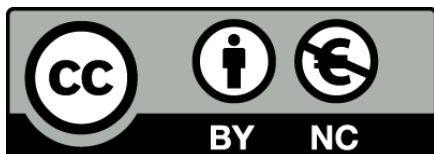
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Key Competences

Each module contains at least key competencies included (ALKCI) by the alphabets in the chart below. There are few module specific ALKCI charts placed among the modules.

Green skills	<ul style="list-style-type: none"> A. Understands the implications of their decisions for sustainable development (Has environmental awareness and willingness to learn about sustainable technologies and understand the need for change, Names generic green skills, Reduces electricity consumption, rational consumption of energy) B. Has skills to facilitate holistic and interdisciplinary approaches (Finds cases of maximising resource efficiency and technologies, products and processes on sustainability) C. Understands environmental legislation (Takes account of new regulation and demographic and environmental changes)
Soft skills	<ul style="list-style-type: none"> D. Understands effective communication E. Uses work ethic F. Understands teamwork in conflict resolution G. Uses time management and efficiency H. Understands responsibility for project work I. Uses critical thinking and curiosity in solving problems J. Creativity and innovation skills K. Customer-oriented service development expertise and customer service skills L. Learning ability M. Problem solving skills N. Networking, partnership and collaboration skills O. Knowledge retrieval skills and knowledge assessment skills
Key Competences	<ul style="list-style-type: none"> P. Utilizing digital solutions Q. Utilization competence of digital platforms, management and control skills of digital functions and utilization competence of solutions R. Digital identity management and protection skills (tools and content) S. Business competence and understanding of earnings logic



module 01

Artificial Intelligence 01

Time frame: 16 hours

Responsible partner: Šolski center Nova Gorica



Basics of statistics

- mean, median, modus
- standard deviation
- histogram

Basics of programming

- variables
- statements
- control structures
- loops
- object oriented programming

Fundamentals of databases

- entities
- attributes
- relationships
- basics of SQL DML

Using spreadsheets

- acquiring data
- using statistical functions
- drawing basic charts

Prerequisites (what student has to master before attending)
(prepared with collaboration with Industry)

MODULE 01	AI
LEVEL OF DIFFICULTY:	LEVEL IV (EQF 4)
TIME FRAME:	16 HOURS

MODULE COMPETENCES:

1. Recognize user needs and find intersection between user needs and AI strength
2. Collect and evaluate data needed
3. Build ML models and explain the results
4. Write an AI application

BUILT IN META SKILLS, GREEN SKILLS AND KEY COMPETENCES

- learn ethical collection of data
- developing multitasking
- developing cooperation and teamwork
- developing customer communication
- development of self-directiveness
- developing multitasking
- developing of resilience and perseverance
- using professional terminology in a foreign language (English)

No.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
1.	<p>Recognize user needs and find intersection between user needs and AI strength</p> <p>ALKCI: D, G, H, J, I, M **</p>	<ul style="list-style-type: none"> ▪ identifies which users problems is AI positioned to solve; ▪ asses automation vs. augmentation; 	<ul style="list-style-type: none"> ▪ describes the fields where AI is used (computer vision, speech recognition, natural language processing, social network filtering, games, mobile advertising,...) ▪ finds the examples where AI is probably better and where rule or heuristic based solution will work <ul style="list-style-type: none"> ○ finds the examples of recommendation system, prediction system, personalization, image recognition, natural language understanding,... where AI adds value ○ finds examples of tasks where AI is probably not the way to go (limited or static information, complete transparency, optimizing for high speed and low cost,...) ○ discusses different use cases ▪ defines user needs, possible solutions and assess whether AI can solve the problem in unique way 	2
2.	<p>Collect and evaluate data needed</p> <p>ALKCI: C, F, K, Q</p>	<ul style="list-style-type: none"> ▪ queries data from multiple sources like relational databases, IOT devices, social networks, data warehouses ▪ knows law and ethical limitation when collecting data 	<ul style="list-style-type: none"> ▪ describes business rules behind given SQL database ▪ analyses data with SQL SELECT clause ▪ gets data with one of the social media analytics tools ▪ names the most important rules of GDPR (General Data Protection Regulation) ▪ reflects on ethical fetching of data ▪ explains null data and outliers in data 	4
3.	<p>Build ML models and explain the results</p> <p>ALKCI: G, E, P, N, O,</p>	<ul style="list-style-type: none"> ▪ explains the difference between supervised, reinforcement and unsupervised machine learning ▪ identifies different ML methods for classification, regression and 	<ul style="list-style-type: none"> ▪ uses one of the classification algorithm (naive Bayes, decision tree, random forest, logistic regression, support vector machines or K nearest neighbours) 	4

	R	clustering <ul style="list-style-type: none"> ▪ uses standard libraries ML methods ▪ explains the result 	on example data <ul style="list-style-type: none"> ▪ evaluates results of classification ▪ uses one of the regression algorithm (linear regression, logistic regression, boosted decision tree or other) on example data ▪ evaluates results of regression 	
4.	Write an AI application ALKCI: A, B, S, P, L	<ul style="list-style-type: none"> ▪ uses image recognition in business application 	<ul style="list-style-type: none"> ▪ names different approaches for image recognition (simple object detection, image matching, image recognition using ML, advanced image recognition) and finds an example of each approach ▪ names differences between image detection an image recognition 	6



module 02

Artificial Intelligence 02

Time frame: 16 hours

Responsible partner: Šolski center Nova Gorica



Basics of statistics <ul style="list-style-type: none"> ▪ mean, median, modus ▪ standard deviation ▪ histogram 	Basics of programming <ul style="list-style-type: none"> ▪ variables ▪ statements ▪ control structures ▪ loops ▪ object oriented programming 	Fundamentals of databases <ul style="list-style-type: none"> ▪ entities ▪ attributes ▪ relationships ▪ basics of SQL DML 	Using spreadsheets <ul style="list-style-type: none"> ▪ acquiring data ▪ using statistical functions ▪ drawing basic charts
Prerequisites (what student has to master before attending) (prepared with collaboration with Industry)			

MODULE 02	AI
LEVEL OF DIFFICULTY:	LEVEL LLL
TIME FRAME:	16 HOURS

MODULE COMPETENCES:

1. Recognize user needs and find intersection between user needs and AI strength
2. Collect and evaluate data needed

BUILT IN META SKILLS, GREEN SKILLS AND KEY COMPETENCES

- learn ethical collection of data
- developing multitasking
- developing cooperation and teamwork
- developing customer communication
- development of self-directiveness
- developing multitasking
- developing of resilience and perseverance
- using professional terminology in a foreign language (English)

No.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
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1.	<p>Recognize user needs and find intersection between user needs and AI strength</p> <p>ALKCI: D, G, H, J, I, M</p>	<ul style="list-style-type: none"> ▪ identifies which users problems is AI positioned to solve; ▪ asses automation vs. augmentation; 	<ul style="list-style-type: none"> ▪ describes the fields where AI is used (computer vision, speech recognition, natural language processing, social network filtering, games, mobile advertising,...) ▪ finds the examples where AI is probably better and where rule or heuristic based solution will work <ul style="list-style-type: none"> ○ finds the examples of recommendation system, prediction system, personalization, image recognition, natural language understanding,... where AI adds value ○ finds examples of tasks where AI is probably not the way to go (limited or static information, complete transparency, optimizing for high speed and low cost,...) ○ discusses different use cases ▪ defines user needs, possible solutions and assess whether AI can solve the problem in unique way 	8
2.	<p>Collect and evaluate data needed</p> <p>ALKCI: C, F, K, Q</p>	<ul style="list-style-type: none"> ▪ queries data from multiple sources like relational databases, IOT devices, social networks, data warehouses ▪ knows law and ethical limitation when collecting data ▪ joins and aggregates collected data ▪ visualizes collected data ▪ describes the statistical properties of the data ▪ finds correlations between data 	<ul style="list-style-type: none"> ▪ describes business rules behind given SQL database ▪ analyses data with SQL SELECT clause ▪ fetches and stores data from IOT device ▪ gets data with one of the social media analytics tools ▪ explains value of social media data ▪ names the most important rules of GDPR (General Data Protection Regulation) ▪ reflects on ethical fetching of data ▪ plans new ways of collecting data ▪ joins collected data from multiple sources ▪ describes statistics of data (mean, median, modus, standard deviation) ▪ explains null data and outliers in data ▪ visualizes data (Python, R or PowerBI, Excel, Google sheets,...) <ul style="list-style-type: none"> ○ draws line chart 	8

			<ul style="list-style-type: none">○ draws bar chart○ draws histogram○ draws scatter plot▪ discusses correlation between data	
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module 03

Artificial Intelligence 03

Time frame: 16 hours

Responsible partner: Šolski center Nova Gorica



Basics of statistics

- mean, median, modus
- standard deviation
- histogram

Basics of programming

- variables
- statements
- control structures
- loops
- object oriented programming

Fundamentals of databases

- entities
- attributes
- relationships
- basics of SQL DML

Using spreadsheets

- acquiring data
- using statistical functions
- drawing basic charts

Prerequisites (what student has to master before attending)
(prepared with collaboration with Industry)

MODULE 03	AI
LEVEL OF DIFFICULTY:	LEVEL LLL
TIME FRAME:	16 HOURS

MODULE COMPETENCES:

1. Build ML models and explain the results
2. Write an AI application

BUILT IN META SKILLS, GREEN SKILLS AND KEY COMPETENCES

- learn ethical collection of data
- developing multitasking
- developing cooperation and teamwork
- developing customer communication
- development of self-directiveness
- developing multitasking
- developing of resilience and perseverance
- using professional terminology in a foreign language (English)

No.	Competence	Professional skills (built in meta &	Learning outcomes	Time
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		green skills)		frame
1.	Build ML models and explain the results ALKCI: G, E, P, N, O, R	<ul style="list-style-type: none"> ▪ explains the difference between supervised, reinforcement and unsupervised machine learning ▪ identifies different ML methods for classification, regression and clustering ▪ uses standard libraries ML methods ▪ explains the result 	<ul style="list-style-type: none"> ▪ uses one of the classification algorithm (naive Bayes, decision tree, random forest, logistic regression, support vector machines or K nearest neighbours) on example data ▪ evaluates results of classification ▪ uses one of the regression algorithm (linear regression, logistic regression, boosted decision tree or other) on example data ▪ evaluates results of regression ▪ uses K-means clustering method on example data 	8
2.	Write an AI application ALKCI: A, B, S, P, L	<ul style="list-style-type: none"> ▪ uses image recognition in business application ▪ creates a recommender system 	<ul style="list-style-type: none"> ▪ names different approaches for image recognition (simple object detection, image matching, image recognition using ML, advanced image recognition) and finds an example of each approach ▪ names differences between image detection an image recognition ▪ finds different use cases of image recognition ▪ uses collaborative filtering, content based filtering for recommending choices ▪ writes a simple recommender system ▪ examines properties of time series objects ▪ plots time series data 	8



module 04

Cyber Security 01

Time frame: 16 hours

Responsible partner: Šolski center Nova Gorica



Basics of:
operating systems

Basics of:
computer networks

Fundamentals of:
databases

Prerequisites (what student has to master before attending)
(prepared with collaboration with Industry)

MODULE NO 04	CS
LEVEL OF DIFFICULTY:	LLL
TIME FRAME:	16 HOURS

MODULE COMPETENCES:

1. Basic security concepts
2. Cryptography
3. Secure network administration
4. Threat and vulnerability assessment
5. Incident detection, response and remediation

No.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
1.	Basic security concepts ALKCI: A,D, L	<ul style="list-style-type: none"> • Lists basic security elements. • Lists standards affecting cybersecurity. • Secure the electronic device or information source. 	<ul style="list-style-type: none"> • Defines principles of information security. • Describes authentication, authorization, access control, and data integrity. • Performs data backup. 	3

			<ul style="list-style-type: none"> Identifies security threats. 	
2.	<p>Cryptography</p> <p>ALKCI: B,E,L</p>	<ul style="list-style-type: none"> Understand basic elements of cryptography. Lists basic cryptographic algorithms. Describe digital signature and usage. 	<ul style="list-style-type: none"> Describes basic cryptography terminology. Lists fundamental principles of cryptography. Differentiates between symmetric and asymmetric encryption. Describes public and private key pairs concept. 	4
3.	<p>Secure network administration</p> <p>ALKCI: A,E,F</p>	<ul style="list-style-type: none"> Identify anomalies in network traffic. Lists network infrastructure vulnerabilities. Distinguish between purposes of network hubs, routers and switches. 	<ul style="list-style-type: none"> Describe network terminology. Identifies network types. Lists wireless encryption algorithms. 	3
4.	<p>Threat and vulnerability assessment</p> <p>ALKCI: A, F</p>	<ul style="list-style-type: none"> Identify critical target elements. Aware of threats, threat tactics and methodologies. Identify malicious activity. 	<ul style="list-style-type: none"> Describe malware types. Understands root causes of vulnerabilities. Uses sniffing tools. 	3
5.	<p>Incident detection, response and remediation</p> <p>ALKCI: D, F, I</p>	<ul style="list-style-type: none"> Monitor continuously for any incidents or threats. Discuss about the instances of cyber attacks. Reports security status of a system. 	<ul style="list-style-type: none"> Explains purpose of security elements like firewall, IDS, ... Provides incident reports and findings. 	3



module 05

Cyber Security 02

Time frame: 16 hours

Responsible partner: Šolski center Nova Gorica



Basics of:
operating systems

Basics of:
computer networks

Fundamentals of:
databases

Prerequisites (what student has to master before attending)
(prepared with collaboration with Industry)

MODULE NO 05	CS
LEVEL OF DIFFICULTY:	LLL
TIME FRAME:	16 HOURS

MODULE COMPETENCES:

1. Penetration testing

No.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
1.	Penetration testing ALKCI: A,D, L	<ul style="list-style-type: none"> Security related information gathering. Passive and active footprinting. Vulnerability scanning and enumeration of targets. Perform authorized or simulated penetration testing of applications and systems. Use automated security assessment tools to perform security assessments of IoT solution components. 	<ul style="list-style-type: none"> Describes ethical hacking techniques. Differentiates between active and passive information gathering about selected target. Uses program tools to gather information about target systems. Describe scan types and objectives of scanning. 	16

			<ul style="list-style-type: none">• Understands enumeration and enumeration techniques.• Describe sniffing tools and understand their output.• Describes methods used to gain access to systems.• Describes methods used to escalate privileges.• Reflects on IoT security and hacking technologies.	
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module 06

Cyber Security 03

Time frame: 16 hours

Responsible partner: Šolski center Nova Gorica



Basics of:
operating systems

Basics of:
computer networks

Fundamentals of:
databases

Prerequisites (what student has to master before attending)
(prepared with collaboration with Industry)

MODULE NO 06	CS
LEVEL OF DIFFICULTY:	LLL
TIME FRAME:	16 HOURS

MODULE COMPETENCES:

1. Web application security

No.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
1.	Web application security ALKCI: A,D, L	<ul style="list-style-type: none"> Identify features of common web server architecture. Identify web application vulnerabilities. Describe web application attacks. Identify web application hacking tools. 	<ul style="list-style-type: none"> Identifies most common vulnerabilities in modern web servers. Explains web application security flaw selected from OWASP top ten list. Performs SQL injection in simulated environment. Performs cross site scripting (XSS) attack in a simulated 	16

			environment. <ul style="list-style-type: none">• Uses program tools to test web applications vulnerabilities.	
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module 07

Introduction to Data Acquisition (digitization): Data Extraction

Time frame: 12 hours

Responsible partner: Šolski center Kranj
Author of the LLL training: Luka Colarič



Basics of: • programming, • EXCEL, • SQL	Basics of: • statistics	Basics of: • electrical engineering and • microcontrollers	Other: • communication skills (written and oral) • foreign language skills
Prerequisites (what student has to master before attending) (prepared with collaboration with Industry)			

MODULE 01	DATA SCIENCE
LEVEL OF DIFFICULTY:	
TIME FRAME:	12 HOURS

KOMPETENCE:
<ol style="list-style-type: none"> 1. Data acquisition 2. Data processing

Nr.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
1.	Data acquisition (IOT) AKCI: A, B, G, J	<ul style="list-style-type: none"> • identification of different data types • basic use and programming of the microcontroller • use of microcontroller sensors 	Participant: <ul style="list-style-type: none"> • distinguishes between different types of data <ul style="list-style-type: none"> ○ by continuity (continuous / discrete). ○ by content (integer / decimal) 	Theory and practice: 12 hours

			<ul style="list-style-type: none"> number, binary, character strings, ...). ○ by capture frequency (and size). ○ by source (sensors, database / API calls) ● programmes the microcontroller ● connects sensors to microcontrollers 	
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module 08

Introduction to Data Acquisition (digitization): Data Processing and Data Storage

Time frame: 12 hours

Responsible partner: Šolski center Kranj
Author of the LLL training: Luka Colarič



Basics of: • programming, • EXCEL, • SQL	Basics of: • statistics	Basics of: • electrical engineering and • microcontrollers	Other: • communication skills (written and oral) • foreign language skills
Prerequisites (what student has to master before attending) (prepared with collaboration with Industry)			

MODULE 08	DATA SCIENCE
LEVEL OF DIFFICULTY:	
TIME FRAME:	12 HOURS

KOMPETENCE:
<ol style="list-style-type: none"> 1. Data processing 2. Data storage

Nr.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
1.	Data processing AKCI: A, B, L, J	<ul style="list-style-type: none"> • setting up your own server to communicate with external microcontrollers • retrieving data to the server from microcontrollers 	Participant: <ul style="list-style-type: none"> • knows basics of Python • set up a basic server with "routes" to extract data from sensors. • tests the server with different data types. • set up a simple database for storing data (sensor ID, values, "timestamp", ...). 	Theory + practice 4 hours

2.	<p>Data storage</p> <p>AKCI: A, B, G, J</p>	<ul style="list-style-type: none"> storing data from microcontrollers in databases 	<p>Participant:</p> <ul style="list-style-type: none"> prints out of data (The data should at least consist of the device ID, sensor code, sensor values, status of the output device, time of data acquisition / arrival) on the server; example: for light sensor controlling light ID1; LUX; 222; ON; 1615485672 with the help of the split function, he is able to extract the necessary data and filters it if necessary, then saves it in the database makes the server to (depending on the remaining time): <ul style="list-style-type: none"> In case of motivation only, the participants should "play by themselves" - end Lists the status of all connected microcontrollers. Displays a warning, depending on the status of a sensor. Sends SMS (smsAPI) or e-mail based on sensor status.... 	<p>Theory and practice: 8 hours</p>
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module 09

Introduction to Data Acquisition (digitization): Decision System and Connection to Output Devices

Time frame: 9 hours

Responsible partner: Šolski center Kranj
Author of the LLL training: Luka Colarič



Basics of: <ul style="list-style-type: none"> • programming, • EXCEL, • SQL 	Basics of: <ul style="list-style-type: none"> • statistics 	Basics of <ul style="list-style-type: none"> • electrical engineering and • microcontrollers 	Other: <ul style="list-style-type: none"> • communication skills (written and oral) • foreign language skills
Prerequisites (what student has to master before attending) (prepared with collaboration with Industry)			

MODULE 09	DATA SCIENCE
LEVEL OF DIFFICULTY:	
TIME FRAME:	9 HOURS

KOMPETENCE:
1. Creation of decision system and 2. Connection to output devices

Nr.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
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1.	<p>Creation of decision system</p> <p>AKCI: A, B, L, J</p>	<ul style="list-style-type: none"> • system decision-making based on input data 	<p>Participant:</p> <ul style="list-style-type: none"> • programmes microcontroller for output device control • gets overview of different spectrum of output devices. • uses simple digital outputs (lights, relays, valves, ...). • uses more complex digital outputs ("programmable RGB strip", monitors, speaker, ...). 	<p>Theory + practice 4 hours</p>
2.	<p>Connection to output devices</p> <p>AKCI: A, B, G, J</p>	<ul style="list-style-type: none"> • Local control of microcontroller output devices - based on local data available to the microcontroller • server control of microcontroller output devices - according to commands from the server 	<p>Participant:</p> <ul style="list-style-type: none"> • programmes microcontrollers to control output devices. • programmes the interaction between output and input devices. • prepares microcontrollers to receive commands from the server. • 	<p>Theory: 5 hours</p>



module 10

Promoting Entrepreneurship

(Production Process Development)

Time frame: 8 hours

Responsible partner: Šolski center Kranj
Author of the LLL training: Sašo Bizant



No previous knowledge needed

Prerequisites (what student has to master before attending)
(prepared with collaboration with Industry)

MODULE 05	PRODUCTION PROCESS DEVELOPMENT
COURSE	PROMOTING ENTREPRENEURSHIP
TIME FRAME:	8 HOURS

KOMPETENCE:

1. Ability to create new business ideas

Nr.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
2.	Ability to create new business ideas AKCI: H, I, J, K, M, S	<ul style="list-style-type: none"> • Creativity, • Innovation, • Entrepreneurship 	Participant: <ul style="list-style-type: none"> • gets acquainted with the concept of entrepreneurship • can use methods of Design Thinking • gets acquainted with the concept of lean production • uses Canvas Business Model on practical case 	Theory + practice 8 hours

			presents his idea - pitching	
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module 11

Basics of 3D Design in SolidWorks 1

Time frame: 14 hours

Responsible partner: Šolski center Kranj

Author of the LLL training: Aleš Kozjek



Basic knowledge of
Microsoft Windows

Prerequisites (what student has to master before attending)
(prepared with collaboration with Industry)

MODULE 01	PRODUCTION PROCESS DEVELOPMENT
LEVEL OF DIFFICULTY:	
TIME FRAME:	14 HOURS

KOMPETENCE:

1. Early product development – use of SolidWorks

Nr.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
3.	Early product development – use of SolidWorks AKCI: A, B, G, J	<ul style="list-style-type: none"> • Design of the mechanical part of the model 	Participant: <ul style="list-style-type: none"> • knows the most globally widespread 3D design programs • draws up a plan for the model in a software environment for 3D modelling (SolidWorks) • makes technical documentation in a software environment for 3D design (SolidWorks) 	Theory and practice: 14 hours



module 12

Basics of 3D Design in SolidWorks 2

Time frame: 10 hours

Responsible partner: Šolski center Kranj

Author of the LLL training: Aleš Kozjek



Basic knowledge of
Microsoft Windows

Prerequisites (what student has to master before attending)
(prepared with collaboration with Industry)

MODULE 01	PRODUCTION PROCESS DEVELOPMENT
LEVEL OF DIFFICULTY:	
TIME FRAME:	10 HOURS

KOMPETENCE:
1. Early product development – use of SolidWorks

Nr.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
4.	Early product development – use of SolidWorks AKCI: A, B, G, J	<ul style="list-style-type: none"> Construction of the mechanical part of the model 	Participant: <ul style="list-style-type: none"> knows how to use the basic tools for designing simple 3D assemblies designs simple 3D assembly in SolidWorks makes a workshop drawing in SolidWorks 	Theory and practice: 10 hours



module 13

MeWeT

Time frame: 8 hours

Responsible partner: SATAEDU



Basics of electrical engineering

- Current
- Voltage
- resistance
- Grounding

Basics of automation technology

- Sensors
- PLC I/O

Fundamentals of digital technology and telecommunications

- Basic of PLC programming
- configuring of Grafana browser

Electronic Measurements

- Use measuring devices
- voltage Measurements

Prerequisites (what student has to master before attending)
(prepared with collaboration with Industry)

MODULE 13	ROBOTICS ENGINEERING
LEVEL OF DIFFICULTY:	LLL
TIME FRAME:	8 HOURS

MODULE COMPETENCES:

1. Installing and wiring a sensor to the PLC I/O
2. Programming of PLC
3. Configuring browser
4. Perform commissioning and documentation

BUILT IN META SKILLS, GREEN SKILLS AND KEY COMPETENCES

- Development of self-directiveness;
- developing multitasking;
- developing cooperation and teamwork;
- developing flexibility;
- developing empathy and communication;
- development of resilience and perseverance
- *literacy*
- *languages*
- *digital*

No.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
1.	Installing and wiring a sensor to the PLC I/O ALKCI: A, B, C, E, H, I, J, L, M, N, O, P	<ul style="list-style-type: none"> ▪ follows and interprets the documents, instructions and plans required for the installation 	The student knows the most common sensors and the I/O wiring	2
2.	Programming of PLC ALKCI: A, B, C, E, H, I, J, L, M, N, O, P	<ul style="list-style-type: none"> ▪ Contacting PLC ▪ identifying the correct place for coding the new sensor 	The student knows how to make connection with PLC and make changes to the coding	2
3.	Configurating browser ALKCI: A, B, C, E, H, I, J, L, M, N, O, P	<ul style="list-style-type: none"> ▪ Contacting the Grafana website ▪ configurating the new sensor with Grafana UI 	The student is able contact and configure new sensor with software	2
4.	Perform commissioning and documentation ALKCI: A, B, C, E, H, I, J, L, M, N, O, P	<ul style="list-style-type: none"> ▪ performs commissioning of the system ▪ tests that the sensor is working and correct operation of the sensor ▪ document the changes 	The student is able to use the system and understands how the changes effect and know how to document the changes.	2



module 14

Rainwater

Time frame: 18 hours

Responsible partner: SATAEDU



Basics of electrical engineering

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Basics of automation technology

- TwinCAT3 Beckhoff software
- Virtual machine
- Structured text as programming language for PLC
- creating HMI

Fundamentals of digital technology and telecommunications

Electronic Measurements

-

Prerequisites (what student has to master before attending)
(prepared with collaboration with Industry)

MODULE 14	ROBOTICS ENGINEERING
LEVEL OF DIFFICULTY:	LLL
TIME FRAME:	18 HOURS

MODULE COMPETENCES:

5. Prepares and installs a software to computer
6. Writing the logic for the system
7. Using and testing the VR system with PLC
8. Performing maintenance, service and documents the installation

BUILT IN META SKILLS, GREEN SKILLS AND KEY COMPETENCES

- Development of self-directiveness;
- developing multitasking;
- developing cooperation and teamwork;
- developing flexibility;
- developing empathy and communication;
- development of resilience and perseverance
- *literacy*
- *languages*
- *digital*

No.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
1.	Prepares and installs a software to computer ALKCI: A, B, C, E, H, I, J, L, M, N, O, P	<ul style="list-style-type: none"> ▪ Installing the software TwinCAT3 on a home computer ▪ Student gets familiarize with a Virtual Machine and HMI ▪ Student creates a Virtual Machine 	Student knows how to install the software and gets familiarized with the Virtual software	6
2.	Writing the logic for the system ALKCI: A, B, C, E, H, I, J, L, M, N, O, P	<ul style="list-style-type: none"> ▪ Writing the logic of the rainwater installation in Structured Text 	Student writes the code based to the rainwater process	5
3.	Using the VR system with PLC ALKCI: A, B, C, E, H, I, J, L, M, N, O, P	<ul style="list-style-type: none"> ▪ Running the PLC-program in the virtual machine 	Student is able to use rainwater system	5
4.	Testing the VR system with PLC ALKCI: A, B, C, E, H, I, J, L, M, N, O, P	<ul style="list-style-type: none"> ▪ Student tests the Virtual Machine 	Student is able to make changes in the software.	2



module 15

Water Process

Time frame: 8 hours

Responsible partner: SATAEDU



<p>Basics of electrical engineering</p> <ul style="list-style-type: none"> ▪ Current ▪ Voltage ▪ resistance ▪ Grounding ▪ 	<p>Basics of automation technology</p> <ul style="list-style-type: none"> ▪ bus technology (Ethernet...) ▪ Sensors ▪ Actuators (Motors, valves...) 	<p>Fundamentals of digital technology and telecommunications</p> <ul style="list-style-type: none"> ▪ Basic logic circuits ▪ Basics of TCP / IP (IP number, subnet mask, default gateway, DHCP, DNS, DynDNS), ▪ VPN, Virtual Private Network, 	<p>Electronic Measurements</p> <ul style="list-style-type: none"> ▪ Use measuring devices ▪ power Measurements ▪ voltage Measurements ▪ Resistance ▪
<p>Prerequisites (what student has to master before attending) (prepared with collaboration with Industry)</p>			

MODULE 15	ROBOTICS ENGINEERING
LEVEL OF DIFFICULTY:	LLL
TIME FRAME:	8 HOURS

<p>MODULE COMPETENCES:</p> <p>9. Preparing and programming the remote connection via VPN.</p> <p>10. Make the installation and commissioning of the both system of I/O and waterprocess.</p> <p>11. Programming of both PLC's</p> <p>12. Perform maintenance, service and documents the installation</p>
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<p>BUILT IN META SKILLS, GREEN SKILLS AND KEY COMPETENCES</p> <ul style="list-style-type: none"> ▪ Development of self-directiveness; ▪ developing multitasking; ▪ developing cooperation and teamwork; ▪ developing flexibility; ▪ developing empathy and communication; ▪ development of resilience and perseverance ▪ <i>literacy</i> ▪ <i>languages</i> ▪ <i>digital</i>

No.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
1.	<p>Preparing and programming the remote connection via VPN.</p> <p>ALKCI: A, B, C, E, H, I, J, L, M, N, O, P</p>	<ul style="list-style-type: none"> ▪ follows and interprets the documents, instructions and plans required for the installation of computer network equipment ▪ ensures materials required for the installation of computer network equipment and ensure their condition ▪ selects suitable devices and takes into account the characteristics of IIOT data network devices ▪ knows the structure and protocols of the data network; ▪ plans and prepares the installation work; 	The student knows the most common switches and understands the general operating principles of switches	2
2.	<p>Make the installation and commissioning of the both system of I/O and water process.</p> <p>ALKCI: A, B, C, E, H, I, J, L, M, N, O, P</p>	<ul style="list-style-type: none"> ▪ Wiring the system and sensors ▪ Secures that the wiring works between the logic in conjunction with the devices of the system 	The student knows how to make wiring and secures the data and valve and motors and commissioning the process	1
3.	<p>Programming of both PLC's</p> <p>ALKCI: A, B, C, E, H, I, J, L, M, N, O, P</p>	<ul style="list-style-type: none"> ▪ programming the logic according the demand ▪ testing the system 	The student is able to use a system, make changes to the operation, understand the importance of safe and economical use. Operation can be done locally and remotely using IIOT.	4
4.	<p>Perform maintenance, service and documents the installation</p> <p>ALKCI: A, B, C, E, H, I, J, L, M, N, O, P</p>	<ul style="list-style-type: none"> ▪ performing maintenance ▪ documenting the changes 	The student is able to service and maintain a system, communication connections and document changes. Some of the maintenance tasks can be performed locally and some also with the help of IIOT.	1



module 16

IoT Sensor Network on Processes for Intelligent Predictive enterprise and cybersecurity

<https://youtu.be/pYEoTRZPYlw>

Time frame: 8 hours

Responsible partner: ISIS ARTURO MALIGNANI



Basics of electrical engineering <ul style="list-style-type: none"> ▪ Current ▪ Voltage ▪ resistance ▪ Grounding ▪ 	Basics of automation technology <ul style="list-style-type: none"> ▪ bus technology (Ethernet...) ▪ Sensors ▪ Actuators (Motors, valves...) 	Fundamentals of digital technology and telecommunications <ul style="list-style-type: none"> ▪ Basic logic circuits ▪ Basics of TCP / IP (IP number, subnet mask, default gateway, DHCP, DNS, DynDNS), ▪ VPN, Virtual Private Network, 	Electronic Measurements <ul style="list-style-type: none"> ▪ Use measuring devices ▪ power Measurements ▪ voltage Measurements ▪ Resistance ▪
Prerequisites (what student has to master before attending) (prepared with collaboration with Industry)			

MODULE 16	ROBOTICS ENGINEERING
LEVEL OF DIFFICULTY:	LLL
TIME FRAME:	8 HOURS

MODULE COMPETENCES:
<ol style="list-style-type: none"> 1. Analyse process needs and requirements 2. Basics of sensors applied in a process case study 3. Basic concepts of cybersecurity 4. Personal work of system analysis and design

BUILT IN META SKILLS, GREEN SKILLS AND KEY COMPETENCES
<ul style="list-style-type: none"> ▪ Development of self-directiveness;

- developing multitasking;
- developing cooperation and teamwork;
- developing flexibility;
- developing empathy and communication;
- development of resilience and perseverance

No.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
1.	Analyse process needs and requirements	<ul style="list-style-type: none"> ▪ Industrial process risks identification ▪ main production losses identification, ▪ energy waste reduction, ▪ productivity improvement, ▪ down-time reduction by predictive maintenance 	<p><i>Understand main productions process and operation requirements</i></p> <p><i>Understand how losses and energy waste affects plant performance</i></p> <p><i>Understand how maintenance can positively affect plant performances</i></p>	1
2	Basics of sensors applied in a process case study	<ul style="list-style-type: none"> ▪ IOT basic IoT sensors ▪ Main M2M-IoT communication protocols, ▪ Basics on IoT infrastructures ▪ Specific sensors used in foundries 	<ul style="list-style-type: none"> ▪ Identify main sensors used in IOT ▪ Understand how a IoT infrastructure works ▪ Know how wiring of sensors can be carried out ▪ Identify main communicating protocols used in IOT 	2
3	Basic concepts of cybersecurity	<ul style="list-style-type: none"> ▪ Process data security needs <ul style="list-style-type: none"> • Security risks • Security risks mitigation ▪ Best practices on cybersecurity 	<ul style="list-style-type: none"> ▪ Recognize importance of security on production processes ▪ Understand basic strategies to improve cybersecurity ▪ Know state of the art of cybersecurity based on best practice. 	1
4	Personal work on system analysis and design by means of a assignment	<ul style="list-style-type: none"> ▪ Critical thinking ▪ Problem solving 	<ul style="list-style-type: none"> ▪ List possible improvements in a industrial production plant. ▪ Research on the Internet IoT sensors solutions ▪ Design a infrastructure plan to deploy improvements 	4

			<ul style="list-style-type: none">▪ Make a predictive maintenance requirements specification▪ Understand cybersecurity issues▪ Analyze alternatives and solutions to the problem based on suppliers' proposals.	
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module 17

MangroviaIoT – An Asset Management and Operational Intelligence Platform

<https://youtu.be/ISGjgoj2ek4>

Time frame: 8 hours

Responsible partner: ISIS ARTURO MALIGNANI



basic concepts of mathematics and geometry	▪	basics concepts of object-oriented programming			▪
Prerequisites (what student has to master before attending) (prepared with collaboration with Industry)					

MODULE 17	ROBOTICS ENGINEERING
LEVEL OF DIFFICULTY:	LLL
TIME FRAME:	8 HOURS

MODULE COMPETENCES:
<ol style="list-style-type: none"> 1. Business case study 2. Personal work of system analysis and design

BUILT IN META SKILLS, GREEN SKILLS AND KEY COMPETENCES
<ul style="list-style-type: none"> ▪ Development of self-directiveness; ▪ developing multitasking; ▪ developing cooperation and teamwork; ▪ developing flexibility; ▪ developing empathy and communication; ▪ development of resilience and perseverance

No.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
1.	Business case study	<ul style="list-style-type: none"> ▪ Data management ▪ Data processing ▪ Data visualization 	<ul style="list-style-type: none"> ▪ <i>Know how a state-of-the art project on lot of a production</i> 	4

		<ul style="list-style-type: none"> ▪ Best practices analysis ▪ Benchmark analysis 	<p><i>process can be made based on a true business case study</i></p> <ul style="list-style-type: none"> ▪ <i>Understand how to collect and manage data based on a true business case study</i> ▪ <i>Understand opportunities of lot data analytics based on a true business case study</i> ▪ <i>Understand best possible ways to use, structure and visualise data collected based on a true business case study</i> 	
2	Personal work on system analysis and design by means of a assignment	<ul style="list-style-type: none"> ▪ Critical thinking ▪ Problem solving 	<ul style="list-style-type: none"> ▪ Research on the Internet on data visualisation software available on the market and their main usage ▪ Research on databases used to store data. 	4



module 18

Predictive maintenance models and python AI approach to machine learning

<https://youtu.be/7hXxUhvAd4>

Time frame: 8 hours

Responsible partner: ISIS ARTURO MALIGNANI



basic concepts of mathematics and geometry

basics concepts of object-oriented programming

Prerequisites (what student has to master before attending)
(prepared with collaboration with Industry)

MODULE 18	ROBOTICS ENGINEERING
LEVEL OF DIFFICULTY:	LLL
TIME FRAME:	8 HOURS

MODULE COMPETENCES:

1. Predictive maintenance models
2. Python approach to machine learning
3. Personal work of system analysis and design

BUILT IN META SKILLS, GREEN SKILLS AND KEY COMPETENCES

- Development of self-directiveness;
- developing multitasking;
- developing cooperation and teamwork;
- developing flexibility;
- developing empathy and communication;
- development of resilience and perseverance

No.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
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1	Predictive Maintenance	<ul style="list-style-type: none"> ▪ Maintenance knowledge ▪ Maintenance managements ▪ Maintenance goals 	<p>Identify the main component in a predictive maintenance system.</p> <p>Understand pros and cons of different maintenance techniques</p> <p>Understand how to implement a system based on a benchmark with a true case study</p>	1
	Python approach to machine learning	<ul style="list-style-type: none"> ▪ Python programming ▪ Data prediction 	<p>Make a program by a google python IDE based on true data set and analyse results of prediction</p>	3
	Personal work on system analysis and design by means of a assignment	<ul style="list-style-type: none"> ▪ Critical thinking ▪ Problem solving 	<ul style="list-style-type: none"> ▪ Research on the Internet on how it is possible to implement predictive maintenance and improve reliability by means of artificial intelligence. 	4
		<ul style="list-style-type: none"> ▪ 		



module 19

Robotics engineering

Time frame: 16 hours

Responsible partner: ŠC Velenje



Basics of electrical engineering Current Voltage Resistance Capacitance Basic electronic elements	Basics of automation technology Sensors Actuators (types of motors and valves) Basics of pneumatics and hydraulics Control and regulation technology	Fundamentals of digital technology and telecommunications Basic logic circuits Basics of TCP / IP (IP number, subnet mask, default gateway, DHCP, DNS, DynDNS), VPN, Virtual Private Network, Industrial networks (Profinet, modbus, profinet,...) Bus technology	Electronic Measurements Use of measuring devices power Measurements voltage Measurements Resistance Current measurements Incremental and absolute encoder
Prerequisites (what student has to master before attending) (prepared with collaboration with Industry)			

MODULE 18	ROBOTICS ENGINEERING
LEVEL OF DIFFICULTY:	LLL
TIME FRAME:	16 HOURS

MODULE COMPETENCES:
<ol style="list-style-type: none"> Using a robot in a robot cell and using robotic cell design methods. Make the installation and commissioning of the robot and IIoT computer network equipment. Understanding the basics of SCADA, OPC, data acquisition.

BUILT IN META SKILLS, GREEN SKILLS AND KEY COMPETENCES
<ul style="list-style-type: none"> learn ethical collection of data developing multitasking project management developing cooperation and teamwork development of self-directiveness

- developing of resilience and perseverance
- using professional terminology in a foreign language

No.	Competence	Professional skills (built in meta & green skills)	Learning outcomes	Time frame
1	<p>Basic understanding of robots and robotic manipulation. Using a robotic cell design method.</p> <p>ALKCI: A,D,E,F,I</p>	<ul style="list-style-type: none"> ▪ Introduction to robotics ▪ basic structures of robots ▪ robotic basics, general principles of working with robots, safety, and protection of working with robots. ▪ types of segments and joints ▪ degrees of freedom - not redundant and redundant edge ▪ programming languages ▪ off-line and online programming 	<ul style="list-style-type: none"> ▪ Definition what is a robot. Knows the history of robotics, lists the use of industrial robots, distinguishes between robot types and distinguishes robot by number of axes. ▪ The most common robots and understands the general operating principles of robots as well as knows the basic principles of safe work with robots, hazards for robot operator and knows how to use safety equipment. ▪ Reasons for using industrial robots, understands the coordinate systems and knows the safety instructions for working with robots. 	8
2	<p>Using a robot. Installation and commissioning of the robot and IIoT computer network equipment.</p> <p>ALKCI: C, G</p>	<ul style="list-style-type: none"> ▪ understanding the operation of industrial networks ▪ understanding the basic principles of SCADA, visualization and how to visualize the industrial process ▪ understanding the basics of an OPC server and data acquisition ▪ understanding the basics principles of IIoT and its use. ▪ knows the structure and protocols of the data network and selects suitable devices and considers the 	<ul style="list-style-type: none"> ▪ Knowledge on how to install and commission the robot using the correct installation methods. ▪ Basics of robotics and computer network installations. ▪ Hierarchy of automation, types of data transfer, describes the means of transmission and knows the basic characteristics of the network. ▪ Locally and remotely robot operation using IIoT. 	8

		characteristics of IIoT data network devices.		
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Companies involved in developing the joint curricula:

Organization	Module	EQF level	Companies
Šolski center Nova Gorica	Artificial Intelligence	4,5	U Blox S.p.A., Kolektor Group Slovenia, Domel d.o.o., Mahle EDS d.o.o., Marken Ltd., RLS d.o.o., GEN-I d.o.o., Yaskava Slovenia d.o.o.
Šolski center Nova Gorica	Cyber Security	4,5	U Blox S.p.A., Kolektor Group Slovenia, Domel d.o.o., Mahle EDS d.o.o., Marken Ltd., RLS d.o.o., GEN-I d.o.o., Yaskava Slovenia d.o.o.
SATAEDU	Robotics Engineering	4	Riffid, Cimcorp, Beckhoff, VSP (Vakka-Suomen Puhelin), Sermatech, Prizztech Winnova, ADE, Pintos, UTU Oy, Luvata, Rippertech, Dyme Solutions, Harju Electer (Satmatic)
Šolski center Velenje	Robotics Engineering	4	MEGA M d.o.o., MIEL elektronika d.o.o. AUTOTECH d.o.o., mCost d.o.o.
I.S.I.S. A. Malignani	Robotics Engineering	5	Sorint SpA, Comau SpA
Šolski center Kranj	Production Process Development	4,5	Polycom Škofja Loka d.o.o. , Iskraemeco d.d., Iskra EVS, Hennlich d.o.o., Skupina Domel, Chemets d.o.o.
Šolski center Kranj	Data Science	4,5	Polycom Škofja Loka d.o.o. , Iskraemeco d.d., Iskra EVS, Hennlich d.o.o., Skupina Domel, Chemets d.o.o.
Tallinn Polytechnic	AR	5	Technical University Innovation Center Mektory





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