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INDI4.0



Project No. 2019-1-DE02-KA202-006099



mes Training Curriculums

INDI4.0 Project Stuttgart | 06/2021 Workshop documents Intellectual Output "O2"

Manufacturing Execution System

with Siemens TIA Portal
OPC-UA Client Server

Learning situation: Implementation of the MES <-> PLC / overall communication interface

Competence area / subject: Professional competence

School type / occupational field / occupation: Vocational / technical school / electrical engineering / mechatronics

- Requirement area: Compare and select communication interfaces of an MES. Configure and program the selected interface

Time range: 2 units

Learning factory: Festo CP-Factory and CP-Labs, module turning

Technical settings: Projector, PC with Windows, tablet (WLAN). Internet access, S7 1500 CPU

Software: OPC UA clients with .NET from SIEMENS / TIA V14

Brief description and learning objectives this lesson sequence:

- Complete overview of communication MES - PLC
- Explanation of the difference between "CALL BY VALUE" and CALL BY REFERENCE "

Information about the learning factory

The i4.0 project Offenburg comprises three pillars:

1. **Expansion of the basic laboratory** Drive technology
The basic laboratory was additionally equipped with a servo machine test bench for examining the various electrical machines from Lukas-Nülle. Part of the acquisition is also the Interactive Lab Assistant from Lukas Nülle, with whose help the pupils can work on the interactive experiment set-ups.
2. **Basic control technology laboratory** with 4 CP Labs from Festo Didactic.
The CP Labs are equipped with the application modules "turning", "stacking magazine", "measuring analog", "workpiece output". A CPU 1512 from Siemens is located in each CP Lab. Another module is additionally equipped with an industrial camera from Sick and a module with a Keyence SR-2000 industrial camera for the recognition and evaluation of QR codes by the PLC
3. **CP Factory Industry 4.0** from Festo Didactic with the modules "high-bay warehouse", "basic module switch", "robot assembly cell with Kuka KR6", "robot loading cell with Kuka KR6", "CNC Concept Mill 55",

“basic module with application turning”, “basic module with Analog measurement application ”, “ Basic module with drilling application ”, “ Basic module with pressing application ”, “ Basic module with heating application ”, “ Basic manual workstation module ”, “ Docking AGV ”module and self-propelled AGV system” Robotino ”.

Further information can be found under the following links:

Festo company:

<https://www.festo-didactic.com/de-de/lernsysteme/lernsysteme-fuer-industrie-4.0>

Lucas Nülle company

<https://www.lucas-nuelle.de/191/apg/2/Produkte/Maschinen-Antriebstechnik.htm>

Goal analysis for the binding classification in the learning area lessons / for the course planning:

competency-based goals (1: 1 from BP)	Contents (1: 1 from BP)	Action result	interdisciplinary skills
There is not any	There is not any		

Progress planning

Methodical and didactic information

duration	phase	What is learned Desired competencies	How do you learn?		media	material	Cooperation, notices, Explanations
			Action of the teacher	Action of the pupils			
10	E	Recognize topic or task / problem.	-> How does the communication between PLC <-> MES / general overview work Discussion and issue AB.		PC, B		5. UE Doc 02 Works- heet.docx
45	ERA	Overview of total communication MES - PLC.	Development of board image "Overview of overall communication MES <-> PLC".		T, AB		5. UE Doc 02 Works- heet.docx
20	ERA	Difference between "CALL BY VALUE CALL BY VALUE" and "CALL BY REFERENCE". CALL BY VALUE CALL BY VALUE		Answer questions on the topic or look for possible solutions.	PC, B, AB	AB TIA V14, TIA help portal	5. UE Doc 02 Works- heet.docx
10	K	Knowledge building		Hold knowledge / s on the AB. Present the result (s), describe the procedure, point out any problem (s) that have occurred and point out possible solutions.	PC, TT, AB, B, D		5. UE Doc 02 Works- heet.docx

Abbreviations:

BA = processing, E = opening of lessons, ERA = development, FM = support measure, K = consolidation, KO = confrontation, PD = pedagogical diagnosis, Z = summary; R = reflection, T = review

Phase:

AP = audio player, B = projector, D = document camera, LB = textbook, O = overhead projector, PC = computer, PW = pin board, T = blackboard,

Media:

TT = tablet, WB = whiteboard; SPH = smartphone; ATB = Apple TV box

Further

AA = work order, AB = worksheet, AO = advance organizer, D = file, DK = documentation, EA = individual work, FK = professional competence,

Abbreviations:

FOL = slide, GA = group work, HA = homework, HuL = action and learning situation, I = Information, IKL = I can list, KR = competence grid, L = teacher, LAA = work order solution, LF = learning area, LNF = learning factory, O = folder, P = plenum PA = partner work, PPT = PowerPoint presentation, PR = Presentation, SuS = pupils, TA = blackboard, ÜFK = transferable skills, V = video

k = collective, cooperative = cooperative, i = individual

Learning phase:

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