Modulbezeichnung (eng.)	**Digitalization & Virtualization of ICPS** (Digitalization & Virtualization of ICPS)
Semester	WPM
ECTS-Punkte (Dauer)	5 (1 Semester)
Art	Wahlpflichtmodul Zertifikat Industrial Cyber-Physical Systems
Sprache(n)	Englisch
Studentische Arbeitsbelastung	60 h Kontaktzeit + 90 h Selbststudium
Voraussetzungen (laut MPO)	
Empf. Voraussetzungen	Teilnahme an Modul ICPS
Verwendbarkeit	MaII
Prüfungsform und -dauer	Studienarbeit
Lehr- und Lernmethoden	Seminar
Modulverantwortlicher	A. W. Colombo

Qualifikationsziele
Within a modular structured and reconfigurable smart industrial environment, industrial cyber-physical systems (ICPS) manage, control and monitor physical processes, create a digital copy (cyber-shadow) of the physical world and make decentralized decisions. Over the Internet-of-Things the ICPS communicate and cooperate with each other and humans in real time. Via the Internet-of-Services, both internal and cross-organizational services are offered and both kind of services can be utilized by participants of the whole value chain. Based on the technological concepts of ICPS, IoT and IoS, the students will understand the set of steps required to digitalize HW- and SW-components of an industrial enterprise. Students will be able to analyse those components ("digitalized Things" or "I4.0-components") under the various perspectives, such as data maps, functional descriptions, communications behavior, hardware/assets or business processes.

Lehrinhalte
A description of how development processes, production lines, manufacturing machinery, field devices and the products themselves can be digitalized and configured as Industrial Cyber-Physical Components will be introduced. A set of technologies and architectural patterns to enable the digitalization of industrial cyber-physical systems under the DIN SPEC 91345:2016-04 and Industrial Internet-Reference Architecture standards, based on the 6 vertical individual layers and their interrelationship will be introduced, both in general and in industrial application. This will include: (i) approaches for implementation of a Communication Layer (Basis IEC 62541), (ii) for implementation of an Information Layer (Basis IEC Common Data Dictionary, IEC 61360 Series/ISO13584-42), (iii) for classification and tools (Basis Electronic Device Description (EDD), Field Device Tool (FDT), (iv) for implementation of a Functional and Information Layer (Basis Field Device Integration (FDI) as integration technology), (v) for approaching end-to-end engineering (Basis AutomationML, B2MML) and (vi) for implementing service-oriented, cloud-based and agent-based functional and business processes.

Literatur
Development of Digital Technologies, Digitisation - the future of our economy. Federal Ministry for Economic Affairs and Energy (BMWI). Program AUTONOMIK 4.0.
Industrie 4.0: The Reference Architectural Model Industrie 4.0 (RAMI 4.0). ZVEI - German Electrical and Electronic Manufacturers' Association, Automation Division (see also www.dvi.de).
Vision and Challenges for Realising the I-oT. European Commission, Information Society. 2010.

Lehrveranstaltungen

Dozent	Titel der Lehrveranstaltung	SWS
A. W. Colombo	Digitalization of Industrial Cyber-Physical Systems	2
A. Pechmann	Simulation of Production Systems	2