SIEMENS
Ingenuity for life

Education

OWL University of Applied Sciences

Streamlining software training and product creation for smart production of smart products

Products

Polarion, Teamcenter

Business challenges

Prepare engineering students for future challenges in product development

Teach comprehensive software development methods with traceability

Combine software, hardware and mechanical engineering into mechatronic designs

Use SmartFactoryOWL Industry 4.0 pilot facility for testing

Keys to success

Use Polarion ALM software for comprehensive software development tuition

Converge Polarion ALM and Teamcenter PLM software to combine software and mechanical product lifecycles

Create a unified cross-discipline data repository

Combining Polarion ALM and Teamcenter software, German university achieves a single source of truth for the entire mechatronic product creation process

Software engineering for engineers

"When I joined the university to teach engineers computer sciences, I was surprised to see how little software-minded they are," says Prof. Andreas Deuter, who became professor of computer science in technology and production at the Ostwestfalen-Lippe (OWL) University of Applied Sciences in 2015. "Fifty percent of my students do not have any programming experience at all, and 45 percent only very little." During his 18-year career at a leading electronics company following his studies at the universities of Magdeburg, Germany, Sofia, Bulgaria and Huddersfield, England, Prof. Deuter had been involved in all aspects of software development, from design to project management to quality assurance.

Research and implementation are carried out at SmartFactoryOWL on the university's Lemgo campus, a cutting-edge lab environment for information and communication based automation technologies.

Prof. Deuter is teaching at the department of production and economics, which includes logistics, wood technology and production engineering. "This field is affected by the ongoing digitalization just as much as in our departments for electrical engineering and computer sciences and for machine technology and mechatronics," he says. "Consequently, our students need a profound understanding of digitalization for their future professional lives, we are providing this."

Results

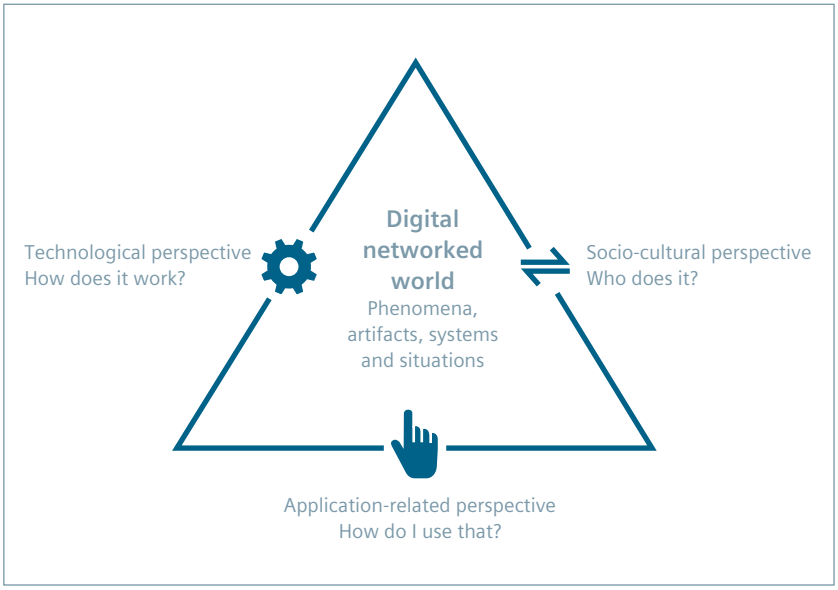
Educated engineers in future-oriented, comprehensive software development with a role-based user experience

Developed methods and procedures for easy implementation in future industrial production facilities based on the Internet of Things

Achieved cross-domain requirements management and traceability

Part of how the professor is achieving this goal is teaching students the basics of software development. This is not limited to only programming using C# as a programming language and Microsoft Visual Studio as a development environment. While in module one of the course, students keep close to programming and data processing topics, module two covers the entire process of software creation, including requirements, change and process as well as quality management.

"The digital, networked world with its phenomena, artifacts, systems and situations has an impact on the way new things need to be designed and built so they can be both compliant and commercially successful," explains M. Eng. Andreas Otte, scientific officer at the department of production and economics of the OWL University of Applied Sciences. "We therefore have students form teams acting in life-like roles such as designers, production or quality managers to perform a comprehensive task covering the entire application lifecycle." The result of the students' work along a continuous workflow from introduction through analysis and design to implementation is software used to control a smart light using devices such as smart phones. The task includes quality assurance as well as software metrics.



The digital, networked world with its phenomena, artifacts, systems and situations has an impact on the way new things need to be designed and built so they can be both compliant and commercially successful. (Image source: https://gi.de/fileadmin/GI/Hauptseite/Themen/Dagstuhl-Erkla__rung_2016-03-23.pdf)

Achieving engineering excellence with ALM

To provide students with a framework supporting this approach, Prof. Deuter has introduced Polarion ALM™ software from product lifecycle management (PLM) specialist Siemens PLM Software. "My team and I had been successfully developing automation software using this software environment during my previous occupation," Prof. Deuter says. "It provided all the support we needed to create excellent products covering all the requirements for documentation and traceability there, so I transferred it to the University."

Polarion ALM is a server-based software suite for application lifecycle management (ALM). It includes tools for workflow-driven software requirements, change and configuration management as well as test and quality management, complete with issues and defects control. The software's modules include tools for planning and resource management and both agile and hybrid project management support. Build and release management is also part of the software's functionality, and so are tools for audits, metrics and reports.

At the department of production and economics of the OWL University of Applied Sciences, students use Polarion ALM software to develop control software for smart lights via the Internet of Things using desktop PC and smart phones.

"The use of the Subversion-based data management structure within Polarion ALM makes it easy to keep track of all aspects of a software project. Along with the workflow-driven procedures managed by the software, it facilitates fast design cycles with little or no error."

M. Eng. Andreas Otte
Scientific Officer
OWL University of Applied Sciences

All data used or generated in Polarion ALM is stored in the form of XML files (work items, wiki, documents) that are committed to Subversion®, an open source version control system included in the package. "The use of the Subversion-based data management structure within Polarion ALM makes it easy to keep track of all aspects of a software project," says Otte. "Along with the workflow-driven procedures managed by the software, it facilitates fast design cycles with little or no error."

Software-driven mechatronic product design

In a joint effort with the Fraunhofer IOSB-INA Industrial Automation branch to empower people and organizations for the digital age, the OWL University of Applied Sciences has installed the SmartFactoryOWL at its Lemgo campus in 2016. It is a cutting-edge lab environment for information and communication automation technologies where the most important research topics for digitization at the shop floor level of the factory of the future are addressed, including adaptability, resource efficiency and cognitive human-machine interaction.

"Converging Polarion ALM and Teamcenter PLM software, we achieve a single source of truth for the entire mechatronic product creation process."

Prof. Andreas Deuter
Professor of Computer Science in Technology and Production
OWL University of Applied Sciences

"Part of our efforts toward research and implementation of smart product creation at the SmartFactoryOWL is the project PLM/ALM for Smart Products. In this cooperation project with Siemens, we combine application lifecycle management for software and product lifecycle management for other product and production aspects to streamline overall mechatronic product creation."

Prof. Andreas Deuter
Professor of Computer Science in Technology and Production
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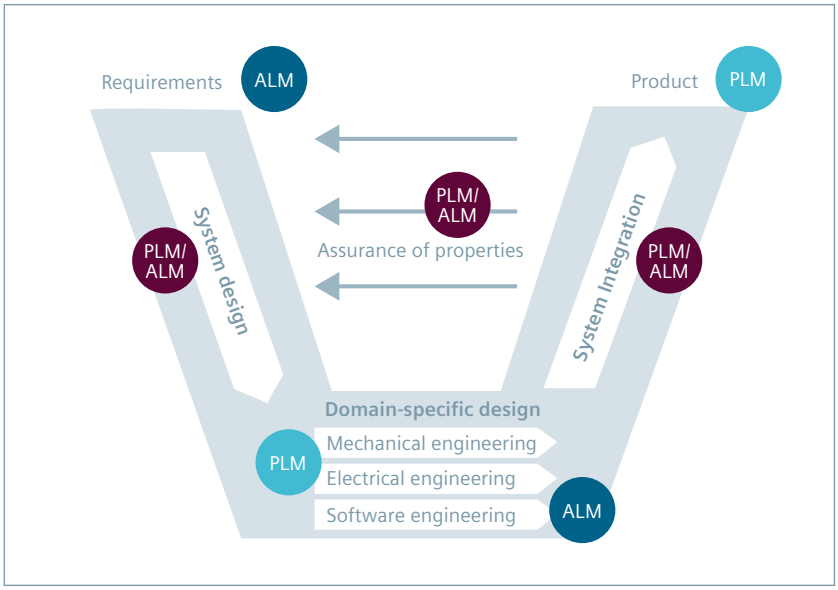
It is there that products like the smart light are produced in a manufacturing system that is flexible and resource-efficient as well as adaptive to humans so it can be operated intuitively. The factory utilizes methods such as additive manufacturing and digital twins of both products and production facilities. Its purpose is to gather knowledge for use in future production systems where plants will control themselves and workpieces will advise the production system how they need to be processed. This will make production much more flexible, allowing mass customization.

"Part of our efforts toward research and implementation of smart product creation at the SmartFactoryOWL is the project PLM/ALM for Smart Products," says Prof. Deuter. "In this cooperation project with Siemens, we combine ALM for software and PLM for other product and production aspects to streamline overall mechatronic product creation."

For non-software product and production tasks, the OWL University of Applied Sciences uses the Teamcenter® portfolio of product lifecycle management solutions. "Both PLM and ALM play an important role in the development of mechatronic products, but in practice, more often than not they are treated as independent and disconnected disciplines," Otte adds. "Our aim is to overcome the disadvantages of missing PLM/ALM convergence such as separate requirements management, interrupted traceability and disconnected project management."



In a joint effort with Siemens to streamline overall mechatronic product creation, the OWL University of Applied Sciences combines application lifecycle management for software and product lifecycle management for other product and production aspects using Teamcenter and Polarion ALM software from Siemens PLM Software. (V-model definition according to VDI2206 guideline)

Solution

Polarion ALM
www.siemens.com/polarion

Teamcenter
www.siemens.com/teamcenter

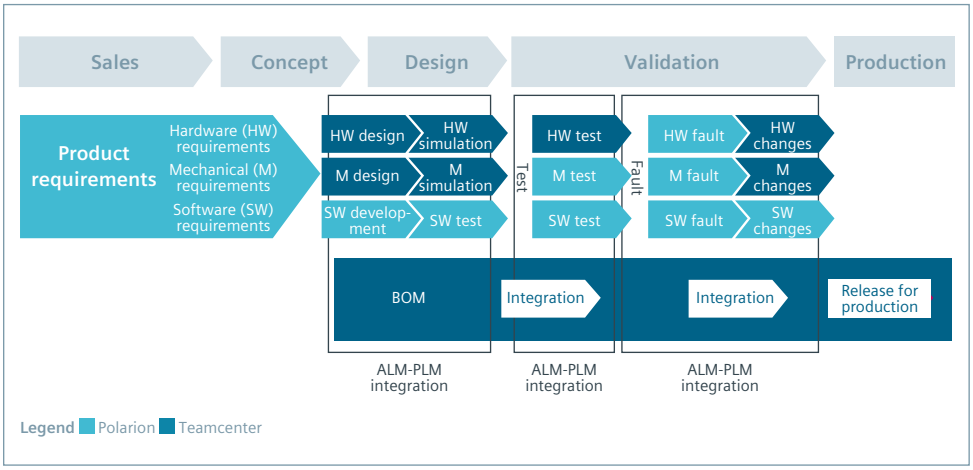
Customer's primary business

With four campuses in Lemgo, Detmold, Höxter and Warburg, Germany, the OWL University of Applied Sciences aims to tackle complex problems and global challenges to ensure that knowledge and innovations benefit society. Lemgo is home to the classic engineering disciplines, supplemented by one-of-a-kind courses such as Media Production, Wood Technology and Food Technology. With 167 professors and more than 460 employees, the university provides education and research in engineering, economics and management, life science technologies, design and construction to nearly 6,600 students.
www.hs-owl.de

Customer location

Lemgo
Germany

In their approach for PLM/ALM convergence, the researchers analyze the strengths and weaknesses of PLM and ALM systems, assign activities to one or the other system and create PLM/ALM-integration where needed. An important step is to create various unified models for use across the combined software landscape. "Converging Polarion ALM and Teamcenter PLM software, we achieve what these systems claim for their respective domains, a single source of truth, for the entire mechatronic product creation process," concludes Prof. Deuter.



The comprehensive mechatronic product creation process using Teamcenter and Polarion ALM software spans all aspects from sales to ideation to design and verification and including production. (Figure inspired by Prendeville, K.; Pitcock,J.: Maximizing the return on your billion-dollar R&D investment: Unified ALM-PLM, Accenture publication, 2013)

> *"Polarion ALM makes it easy to keep track of all aspects of a software project."*
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> M. Eng. Andreas Otte
> Scientific Officer
> OWL University of Applied Sciences

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