



VR-PLC: PLC-Centered VR-Training for Industry 4.0

In the EU research project "VR-PLC: PLC-Centered VR-Training for Industry 4.0", funded by EIT Manufacturing, scientists and users from Ruhr-Universität Bochum, the Institute for Sustainable Technologies of the Łukasiewicz Research Network from Radom, Poland, and LINPRA, the Lithuanian Mechanical Engineering and Technology Association, are working on an introductory course for programming programmable logic controllers. At the heart of the online and hybrid workshop format is the VR-PLC virtual learning environment, where users can interact with an industrial automation systems in VR or via their web browser to test their PLC programs with direct visual feedback.

Companies in Eastern European countries, such as Poland and Lithuania, have a great need to support their employees in training and upskilling in modern technologies. Surveys conducted in the project show that current offerings are not satisfactory in this regard. Training formats are expensive, inflexible and do not cover industrial requirements.

For this reason, scientists and didacticians at the Łukasiewicz Research Network, together with companies from the *Radom Metal Cluster*, an association of metalworking companies around the Polish city of Radom, have set up various PLC techno-educational stands with which trainees can learn the basics of PLC programming in a practical manner.

The aim of EIT Manufacturing is to build an interactive online learning platform for schoolchildren, students, trainees, technicians, and managers to provide the knowledge and skills needed for the digital and climate-neutral transformation of European industry.

The project will produce interactive educational content and videos teaching how to use programmable logic controllers towards the Internet of Things. This online learning is complemented with practical exercises in the developed VR learning environment. The learning environment simulates a simple PLC, which is programmed by the users via an easy-to-use editor. Interactive help functionalities enable users to solve introductory and more advanced tasks with their own programs.

The virtual environment is based on the physical PLC training stands and can be made accessible with VR hardware, such as the Oculus Quest 2. Users thus get an immersive overview of the problem to be solved and experience directly how the just created PLC program interacts with the machinery. For users without VR hardware, the environment can also be explored non-immersively via a web browser.

The environment shows explanatory notes and allows users to interact directly with the various sensors and actuators. Users can also program the PLC in VR, using the same GUI as in the web browser, but on a virtual tablet. The environment is used where it makes didactic sense. Users start with simple problems on a very basic, technical stand to understand the basic elements of the ladder diagram graphical programming language. From there, the tasks and the machine become





progressively larger until realistic problems can be solved. Therefore, the VR environment doesn't stand alone, but is integrated into the online workshop format with videos and micro learning nuggets.

EIT Manufacturing's online learning platform delivers content in reusable learning nuggets, each of which is only between 5 and 15 minutes long and teaches a single concept. Several such nuggets, which can include texts, videos, interactive lectures or short tests, are assembled into a complex learning path, at the end of which the participant receives a certificate for the skills learned. The VR-PLC project shows practically how such learning paths can be enriched with immersive and non-immersive VR learning nuggets. The VR content is seamlessly integrated to the other content on the platform. Participants start the VR environment directly from the online platform, whereupon they can solve the given problem and practice learned knowledge. Successful completion is reported back to the platform, where the learning path continues.

The project thus not only shows how VR can be used practically in education and training today, but also forms the basis for a VR extension of the EIT Manufacturing learning platform.

More Information

<https://www.lde.ruhr-uni-bochum.de/vrplc/>

Contact

Activity Leader

Jan Luca Siewert, M. Sc.

Chair for Digital Engineering

Ruhr-Universität Bochum

Jan.Siewert@ruhr-uni-bochum.de

RUHR
UNIVERSITÄT
BOCHUM

RUB

<https://www.lde.ruhr-uni-bochum.de>



<https://linpra.it/en/>



<https://www.itee.lukasiewicz.gov.pl/en>

