

# Smart, artificial intelligence-based synthesis of Piping and Instrumentation Diagrams (P&IDs)

*J.Oeing<sup>1</sup>, W. Welscher<sup>2</sup>, N. Kockmann<sup>1</sup>,*

*<sup>1</sup>TU Dortmund, AG ApparateDesign, Dortmund/DE,*

*<sup>2</sup>X-Visual Technologies GmbH, Berlin/DE*

The Piping- & Instrumentation Diagrams (P&ID) is one of the most important documents in the process industry. At the same time, its synthesis is a very time consuming and expensive task. However, a closer look shows that the drawing of P&IDs is subject to clear rules of construction. For example, processes contain a large number of recurring functional units and structures, which can be learned with the help of artificial intelligence methods and made available for further applications.

With the steady development of future-proof data structures such as DEXPI (Data Exchange in Process Industry) [1] and the increasing availability of computing power, the barrier to using AI methods is falling. Within the KEEN project the technology company X-Visual Technologies in cooperation with the TU Dortmund University, Laboratory of Equipment Design, develop AI based applications, which recognize patterns and structures in P&IDs and are able to predict connections and functional units for their synthesis.

For implementation, the topologies of the P&IDs are transformed into graphs, and the interrelationships of functional units are extracted using vector space representations. These subsequently serve as a basis for the prediction of subsequent equipment as well as for automated consistency checks of created drawings. In parallel, models for the representation of piping, process, and signal lines are developed and validated.

The BMWi is acknowledged for funding this research as part of the KEEN-Project. (Support code: 01MK20014S, 01MK20014W)

[1] S. Fillinger, H. Bonart, W. Welscher, E. Esche, J.-U. Repke. Improving Interoperability of Engineering Tools – Data Exchange in Plant Design. Chemie Ingenieur Technik. 89,(11), 2017, 1454-1463.

