Industrial Data Services for Quality Control in Smart Manufacturing

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The European manufacturing sector key challenge is to transform cost-based competitive advantages into those that rely on both sustainable and high-value-added production. An important lever to address these challenges is to enable companies in achieving superior product quality with highly efficient, smart production processes during their daily operations. This approach creates new challenges, though, because of the many, highly heterogeneous, and intensely interconnected manufacturing resources and their digital counterparts. A successful smart factory needs to manage data-related processes along the entire data life cycle, including data collection, storage, distribution, analysis, use, and deletion, to always ensure high data quality. This includes processes related to i) the design, deployment, and use of hardware and software; ii) the planning, implementation, and monitoring of intra-organisational procedures; and iii) the inter-organisational practices in the value chain. The comprehensive quality control of all important factors is an effective measure against unfit, erroneous, unintelligible, or otherwise unreliable data.

As an answer to these needs a H2020 European project entitled "Industrial Data Services for Quality Control in Smart Manufacturing" (i4Q) funded under the call H2020-NMBP-TR-IND-2018-2020 "Transforming European Industry" and topic H2020-DT-FOF-11-2020 "Quality control in smart manufacturing (IA)" started in January 2021 with a duration of 3 years. The i4Q project aims to provide a complete set of solutions consisting of IoT-based Reliable Industrial Data Services (RIDS), the so-called 22 i4Q Solutions, able to manage the huge amount of industrial data coming from cheap cost-effective, smart, and small size interconnected factory devices for supporting online monitoring and control in manufacturing procedures related to both machine operations and product quality.

The aim of this workshop is to show the research performed in the project during its first year and to contrast with the research performed in other H2020 projects, academia and industry. Six papers have been presented at the "Industrial Data Services for Quality Control in Smart Manufacturing" workshop:

- *Industrial Data Services for Quality Control in Industry 4.0*: This paper addresses the i4Q project vision, including stakeholders' requirements and expectations, sets clear specifications that drive the creation of i4Q Solutions and identifies the most relevant regulation and trustworthy systems for data management.
- *A Reference Architecture for Data Quality in Smart Manufacturing*: This paper presents the reference architecture used to guide the development of the RIDS, composed by the 22 i4Q Solutions. The proposed reference architecture adopts a three-tiered architectural model to represent the main system architectural components, and provides four different architectural viewpoints to address business, usage, functional, and implementation concerns.
- *Manufacturing Data Security, Trustiness and Traceability*: This paper presents the i4Q Solutions for to control manufacturing Data Security, Trustiness and Traceability with a zero-

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defect approach and provided by the i4Q project. The approach is exemplified with the industrial production line of injected plastic spare parts for the automotive sector.

- *Manufacturing Data Analytics for Manufacturing Quality Assurance*: This paper presents the i4Q Solutions for data integration and fusion, data analytics, data distribution and execution of AI workloads (including at the edge). These solutions allow monitoring at various levels through scalable tools and the collected data is used for a variety of activities including resource monitoring and management, workload assignment, smart alerting, predictive failure and model (re)training.

- *Manufacturing Line Qualification and Reconfiguration*: This paper presents the i4Q Solutions for process qualification, process reconfiguration and optimization using existing manufacturing data and intelligent algorithms for providing manufacturing lines' diagnosis and prescription, process capacity forecasting, manufacturing line reconfiguration propositions, and data quality certifications and audit procedures that aim to improve manufacturing outcomes.

- *Toolkit Conceptualization for the Manufacturing Process Reconfiguration of a Machining Components Enterprise*: This paper depicts the deployment of one of the i4Q Solutions, the i4Q Line Reconfiguration Toolkit (LRT), in FACTOR, a manufacturing company dedicated to metal machining and precision turning. The needs of the company are described, and the expected results are identified once the i4Q LRT is running in production mode.