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A Web and Cloud-Based Measurement System Analysis Tool for the Automotive Industry

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Abstract : Any industrial company needs to determine the amount of variation that exists within its measurement process and guarantee the reliability of their data, studying the performance of their measurement system, in terms of linearity, bias, repeatability and reproducibility and stability. This issue is critical for automotive industry suppliers, who are required to be certified by the 16949:2016 standard (replaces the ISO/TS 16949) of International Automotive Task Force, defining the requirements of a quality management system for companies in the automotive industry. Measurement System Analysis (MSA) is one of the mandatory tools. Frequently, the measurement system in companies is not connected to the equipment and do not incorporate the methods proposed by the Automotive Industry Action Group (AIAG). To address these constraints, an R&D project is in progress, whose objective is to develop a web and cloud-based MSA tool. This MSA tool incorporates Industry 4.0 concepts, such as, Internet of Things (IoT) protocols to assure the connection with the measuring equipment, cloud computing, artificial intelligence, statistical tools, and advanced mathematical algorithms. This paper presents the preliminary findings of the project. The web and cloud-based MSA tool is innovative because it implements all statistical tests proposed in the MSA-4 reference manual from AIAG as well as other emerging methods and techniques. As it is integrated with the measuring devices, it reduces the manual input of data and therefore the errors. The tool ensures traceability of all performed tests and can be used in quality laboratories and in the production lines. Besides, it monitors MSAs over time, allowing both the analysis of deviations from the variation of the measurements performed and the management of measurement equipment and calibrations. To develop the MSA tool a ten-step approach was implemented. Firstly, it was performed a benchmarking analysis of the current competitors and commercial solutions linked to MSA, concerning Industry 4.0 paradigm. Next, an analysis of the size of the target market for the MSA tool was done. Afterwards, data flow and traceability requirements were analysed in order to implement an IoT data network that interconnects with the equipment, preferably via wireless. The MSA web solution was designed under UI/UX principles and an API in python language was developed to perform the algorithms and the statistical analysis. Continuous validation of the tool by companies is being performed to assure real time management of the ‘big data’. The main results of this R&D project are: MSA Tool, web and cloud-based; Python API; New Algorithms to the market; and Style Guide of UI/UX of the tool. The MSA tool proposed adds value to the state of the art as it ensures an effective response to the new challenges of measurement systems, which are increasingly critical in production processes. Although the automotive industry has triggered the development of this innovative MSA tool, other industries would also benefit from it. Currently, companies from molds and plastics, chemical and food industry are already validating it.

Keywords : automotive Industry, industry 4.0, Internet of Things, IATF 16949:2016, measurement system analysis
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