Title: **A Predictive Maintenance model based on Industry 4.0 Asset Administration Shell**

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Abstract: Maintenance is one of the most important aspects in industrial and production environment. Predictive maintenance (PdM) is an approach that aim to schedule maintenance tasks based on historical data coming from embedded systems and sensors applied on machinery in order to avoid machine failures and reducing the costs due to unnecessary maintenance actions. Approaches for the implementation of a maintenance solution often differs depending on the kind of data to be analyzed and on the techniques and models adopted for the failure forecasts and for maintenance decision-making. Nowadays, Industry 4.0 introduces flexible and adaptable manufacturing concept to satisfy a market requiring an increasing demand of customization. In this context, maintenance is of paramount importance since avoiding failures, and thus money loss, is a key requirement in a challenging market requiring high efficiency and availability. The adoption of vendor-specific solutions for predictive maintenance and the heterogeneity of technologies adopted in the brownfield for the condition monitoring of machinery reduce the flexibility and interoperability required by Industry 4.0. Telemetry data for condition monitoring often come from smart sensors and smart devices using embedded systems that computes data and transmit them using vendor-specific protocols and data formats. Furthermore, it is hard to define a PdM solution that can adapt itself to the variation in the configuration of the original production, setting new constraints to the flexibility in the smart factory. For all these reasons, it is needed the definition of new mechanisms for the horizontal integration that hide implementation details and guarantee a communication channel between devices, regardless of both their manufacturer and technologies adopted. In this presentation a logical model for PdM will be pointed out highlighting all the "common factors" between the PdM solutions in literature, generalizing all the aspect that a PdM solution implementation should cope with. Such common factors are grouped in logical blocks containing generic information and functionalities required by one single aspect of the PdM process. The presented PdM model is based on the so-called Asset Administration Shell (AAS) presented in the Reference Architecture Model for Industry 4.0 (RAMI4.0), which is defined as a digital representation of an asset. The conjunction of an asset with its AAS creates the so-called I4.0 Component, which represents the concept of a Cyber-Physical System in RAMI 4.0. The proposed approach leverage on AASs because they create a standardized abstraction layer above assets using different technologies that cannot interoperate each other. Using the same AAS metamodel to expose different data modules by means of a standardized external interface makes the devices seamlessly interoperable, solving the aforementioned issue concerning the massive heterogeneity of technologies adopted in the industrial environment. In this way, the AAS can be used to expose the generic functionalities of a PdM solution in its internal structure. Since the description of a PdM solution is done in terms of generic and technology-independent PdM functionalities, the advantage of this approach consists in an easier reconfiguration and enhancement of the production plant in the context of smart manufacturing. The conjunction of AAS and generic PdM operations allows the definition of roles for devices so that substitution of an equipment with an equivalent one, or the addition of a new equipment, is transparent and non-disruptive from the point of view of the PdM solution. It is worth noting that an AAS for the equipment can be deployed on embedded systems using OPC UA (IEC 62541) for its implementation; OPC UA is defined as the only interoperability technology in industry 4.0 providing a standardized information model and services for secure interaction with data. The Nano Embedded Profile of OPC UA allows the deployment of an OPC UA Server, and thus of an AAS, on constrained devices using a small amount of resources.