Improving the Monitoring of Offshore Wind Power Plants by Integrating Contextual Information from Lifecycle Records

Steffen Dienst, Johannes Schmidt, Jonas Beseler*
University of Leipzig, Leipzig, Germany, +49 341 9733426;
{steffen.dienst | johannes.schmidt }@uni-leipzig.de
**Global Tech I Offshore Wind GmbH, Hamburg, Germany, +49 40 8080754412,*
J.Beseler@globaltechone.de

Summary
Automatic monitoring of offshore wind power plants is a necessity for efficient operation and maintenance. Today, experts often need to interpret anomalies manually, because contextual knowledge is not available. By integrating the monitoring system with a lifecycle record, the overall quality of data analysis results increase and false alarm rates decrease.

1. Introduction

Offshore wind turbines provide operational data that allow operators to monitor their actual state in detail. This is crucial to ensure safe, efficient, and economical operation. A variety of monitoring approaches exist: static threshold definitions, plant-specific models for individual monitoring, or self-learning algorithms that do not require any further knowledge [1]. To ensure high quality of monitoring results, data collection and evaluation processes shall be automated and rest on standardized classifications [2]. However, it is challenging to make reliable statements about the plant, because these data shall be condensed into smart data.

2. Challenges

Modern monitoring systems automatically detect anomalies in sensor data. Their interpretation is challenging, because they often cannot be explained on a solely mathematical level. Contextual knowledge about the turbine or the environmental setup is required, but generally not available in these systems. Thus, an automated interpretation and classification of anomalies is not possible. This leads to high or erroneous incident reporting rates and high efforts for experts. To improve the quality of the anomaly detection including their automated interpretation, a holistic approach is needed that takes a variety of information into account. Such a knowledge artefact is the lifecycle record (LR). According to [3], it contains every plant-related information over the entire lifecycle. Integrating the LR with monitoring systems improves the quality of the monitoring and opens up a large number of potentials.

3. Potentials

In this presentation, we discuss the following selected practical use cases that show the potentials of an integration of monitoring systems with the LR: automatic creation of monitoring rules for sensors, interpretation of SCADA messages and sensor anomalies, and enabling predictions. Monitoring rules can be derived und continuously adjusted from product master data (value ranges, relationships between sensors). Maintenance reports may indicate updated control parametrization or replacement of components and facilitate rule updates. Contextual knowledge from the LR can also help to classify the anomaly und improve the quality of alerts as well as decrease their frequency (recent maintenance actions or tickets describing known issues). Finally, having high quality information about historical alerts, their interpretations and documented root causes allow the application of machine learning algorithms to create predictions of potential defects from actual SCADA messages and monitoring anomalies.

3. References

[1] Dienst S, Beseler J. Automatic Anomaly Detection in Offshore Wind SCADA Data. WindEurope Summit 2016; 2016
[2] Papatzimos A K, Thies, P R. Towards automated and integrated data collection-standardising workflow processes for the offshore wind industry. Offshore Wind Energy 2017; 2017
[3] DIN. DIN 77005-1 Lifecycle record of technical objects - Part 1: Terms and structure; 2017