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Predictive Analytics Is Heart of Digital Transformation for Energy Industry

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Abstract
This paper focus on technologies that could help preventing expensive unexpected failures of equipments which are backbone for the plant operations in energy industry especially in Oil & Gas which is a vast field with numerous equipments and engineering systems that require constant monitoring and maintenance. With innovative technologies available today, energy industry is rapidly growing and have no alternate other than embracing the digital technologies to reinforce their operation and protect their valuable assets. AI and ML plays a crucial role in Digital Transformation of Energy industry, and application of AI and ML algorithms and techniques in making paradigm shift in deploying digital solution for monitoring the performance and prevent catastrophic failures by predicting the performance of engineering assets in advance using Predictive Analytics.

Key Words: Digital Transformation, Data Analytics, Digital Twin, Predictive Analytics

Introduction

Digitising and Digitalization has always been part of galvanising business process. However, breakthrough technologies will make a substantial difference in realizing the value of digitalization. Predictive Analytics is one such technology making waves in the Energy Industry, and it is becoming indispensable for energy industry to maintain their multibillion-dollar assets efficiently by preventing expensive unexpected failures of equipments which are backbone for the operations. The outcome of a project development discussed here would benefit the energy sector in large and it explains how the Predictive Analytics enable energy industry to prevent costly unexpected downtime and suggests how to choose right solution.

Adoption of Right Predictive Analytic System for Energy Industry

Predictive Analytics is useful in early warning detection from critical equipments, in particular the rotary equipments such as compressors, pumps, motors, Turbines, Fans, blowers, gearboxes of rotary equipments. Merely having the data in dashboard and allowing human to analyse the data and make decision will not make any difference when you think of digitalizing assets. The data should be used to read and generate alerts, send early warnings automatically to operators to take the equipment and systems for maintenance and avoid unexpected failures of equipments and its cascading effects on entire operation of plant. The predictive Analytics would not only help avoiding the unexpected failures of equipment, but also could reduce unnecessary regular maintenances and ensure safety of plant assets.

While any organization before choosing the right solution for their Predictive Analytics, a broad level study is essential to implement a Predictive Analytics system successfully and leverage the Technological Advancements.

Here are the few key elements that determine the successful implementation of Predictive Analytics based maintenance system.

1.) Compatibility to fetch the live data from historian and import of data from various sources such as TAS/ DCS/SCADA/ PLC/ OPC/ Data base files etc.

2.) User-friendly and intuitive interface with heavy usage of application using desktop and mobile Apps with dashboards.
3.) The system to be commercially off- the -shelf (COTS) which should allow the users to configure the system and deploy on -premises with standard libraries of models and easy to modify the models.
4.) The system should generate notifications and alerts effectively based on data driven techniques like statistical model and advance analytics using Artificial Intelligence (AI) and Machine Learning (ML).
5.) Compatible to your organizational Data Encryption/Data Protection policy to protect the Data to be used for Predictive Analytics. The data is your digital Asset.
6.) The usability of historian data and non-digital data. Make sure that the historian data, which is available with you, is reusable. Collect the data, which is non-digital format, such as regular maintenance schedule of equipment, history of equipment failures, and reasons why it undergone maintenance even before the schedule, such data and information would enable to build the baseline data model, which will be analysed with live data for predicting unforeseen events in advance.

Alerts Are Your ASSET

While the Predictive Analytics in intended to protect your assets, the Alerts and notifications are the real assets that one should expect from Predictive Analytics system. If a system continues to generate numerous alerts and false alerts, then the reliability of Predictive Analytics will be at a stake. Here comes the role of machine learning (ML) and Artificial Intelligence (AI), which would play a significant role to recognize the pattern from data points and generate the reliable and actionable alerts. So, before you choose a system for Predictive Analytics, it is essential that you should evaluate the standard libraries for various types of equipments and the OOTB model available for various use cases and you can simulate with historian data to ascertain that the system function to it is purpose and then can deploy the system to work with live data coming from various sources. Open sources developments are limited and not proven, while there are Standard industry softwares such as AVEVA Predictive Analytics (earlier known as PRiSM), Hexagon EAM.Baker Hughes Advanced ESP Predictive Failure Analytics, are some of globally adopted solutions, for energy industry Predictive Analytics to protect the critical assets.

Hadwares and Softwares Selection

The success of the system you choose and deploy for Predictive Analytics is fully depending on the right combination of hardwares and softwares. Like any analytical software requires high processing capacity, Predictive Analytics when powered by machine learning, the system should be capable of recognizing the patterns generated by data points coming from sensors every day, week, and month in order identify the deviation. To achieve such robust system, it really requires high-end hardware's and supporting OS and other allied software applications for fetching, integrating, synthesizing the data to be used for analytics. Do not select the hardware's that is nearing end of life and same as OS and other applications. Be conscious about compatibility and capability of the Predictive Analytics system to integrate with your existing systems from where the data to be fetched. Before you move for implementation, through investigation on usability of existing data available in historian shall be conducted to ascertain that the data available is rely upon data to build the models.

An illustration shown below where the Predictive Model developed using historian data for nearly normal operation of an asset is compared with actual data coming from an asset through sensors. Leveraging pattern recognizing algorithms and AI and ML techniques, Alarm/Alerts will be start generating when there is a deviation from the Predictive Model. Also, the traditional alarm which is set based on threshold value which is still far from the actual and predicted model, it allows an operator to have a look at the root cause for this deviation well in advance, before it actually reaches the threshold level and prescribe the action to be performed on the asset being monitored and prevent the costly damage that might occur to the asset.

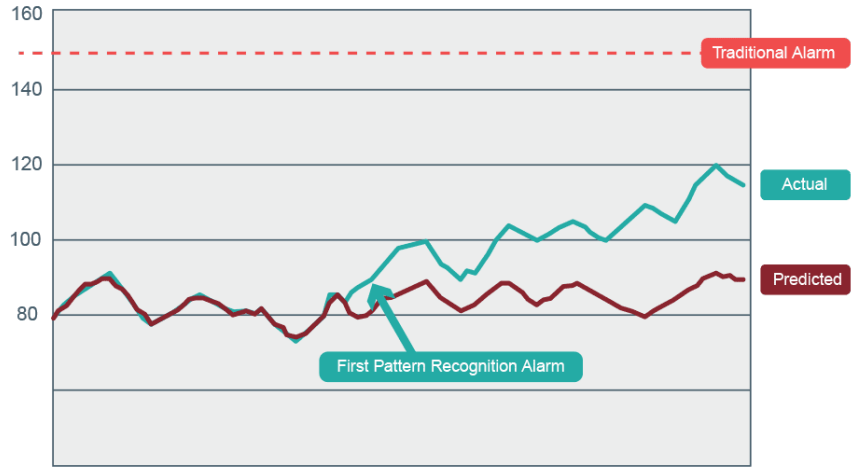

Figure 1: Predictive Model of a Parameter Analysed with Actual Data

Deployment Methodology and KPI of System

More you go digital; more you are vulnerable to risk your assets in terms of data security. An idle Predictive Analytics solution should be deployed on-premises if an organization would avert any incident pertaining to data security. The data security testing for the system should be conducted using VAPT tool or through a CERT. The system performance should be linked to various KPI's for its functionalities to realize the benefits.

Conclusions

Predictive Analytics is a must have solution for engineering industry which is relying on performance of key equipments for the seamless operations and asset management. Predictive Analytics is a step ahead in digital transformation and it is different from the existing control and monitoring systems which work on pre-set values. Predictive Analytics analyse the running data of your assets and warn you if there are potential probability of failure of your engineering systems even before it reaches the pre-set values of any parameters.

Energy Industry capitalizing the Digital Transformation lies on integrating the techniques and technology to the engineering systems. Despite having traditional control and monitoring system, even today there are safety incidents that occurring worldwide which is engulfing invaluable human lives and the assets worth of billions of dollars. While industry think of leveraging technology, reduce human interface, automate the workflow, emphasise should be on health and safety of men and machines.

Digital twin is the Age of Aquarius for Energy Industry. There is no alternate for energy industry to run and maintain giant facilities, which host thousands of equipments and engineering systems other than adopting digital. While adopting to digital, it is not just one solution that industry can look at, they must look at agnostic approach for integrating various tools and technology. That is the key for successful implementation of Predictive Analytics kind of solutions while building digital twin for grassroots facilities.

For brown field facilities, identifying the areas where you intend to implement the solution is the key. Among thousands of equipments, the mother of the process will play the pivotal role in identifying and deploying solution, bearing in view of lifecycle of the Assets. Complete digital revamp of a brown field facilities will attract more challenges such as integrating the innovative technology to outmoded existing facilities, which might not compatible, and it will deviate from the fit for purpose and economically not beneficial when you look at return on investment.

While various methods are available to implement Predictive Analytics for the assets, it is important to analyse the feed for analytics. The feed in the form of data, which might come from various sources such as historian, even mechanical noise that come from equipments, vibrations etc... Here, one should consciously consider the three pillars for successful deployment of solutions. The three pillars include data types, the models you build, and the most important thing that the technology you integrate with the solutions.

Your data available from various sources should enable you to build the models, which will be used as baseline models. For standard industrial equipments, there are built-in models available for various parameters such as the cavitation, Vibration of Pump, lubrication, bearing alignment, surge of compressors. These models are part of software packages, which can be used to build models based on your data. However, if you would like to monitor various other parameters, you should possess usable data to build new models and implement for analytics.

The effective implementation of Predictive Analytics system is fully depending on the technologies you adopt. AI and ML will play a vital role. The model you build based on data would only be baseline statistical model, however the analytics should be a continuous process to evaluate the current data with statistical models and raise alarm. Here the amount of data what you will manage will be a big data and that's where ML to play the critical role of analysing the data coming from live sources that are well recognized, refined and utilized for analytics. Whatever the data types, ML and AI should be capitalized to build models, recognize the patten changes, and alert the operators for decision-making. With the three pillars such as Data types, Models, and Technology, Predictive Analytics will be an impeccable solution for energy industry to solve future problems efficiently and can have a meaningful Digital Twin.

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