Fleet analytics and advanced diagnostic for rotating equipment and turbomachinery

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The low price of oil barrels has been a disruptive force in the oil and gas production chain. The upstream producers, which used to be supported by the high price of the produced goods, had to reconsidering completely their market strategy and to survive in a new challenging market scenario. The downstream and chemical operators, which were used to a low-profitability and high competition market, have the chance to increase their profits and started cautious investments. This challenging new scenario is the perfect ground for the entrance of Internet of Things (IoT) and new digital technologies in a traditionally conservative and innovation resistant industry. The way the IoT technologies are entering into the Oil&Gas industry is based by several layers: the lowest level is based on distributed and low cost sensors that allow to harvest more data across the plant, these data are then collected and crunched to generate useful information of the status of the assets and of the overall plant. The information from different plants are then collected though a cloud-based environment, that enables even more advanced analysis to define the operating strategies of these large industrial sites. In this paper, we present a solution to take advantage of the latest IoT technologies, to support the end users with services and expertise, by turning data insights into direct action that “close the loop” and generate user value in the physical world. The funding layer of this infrastructure is field level data harvesting, in particular by enhancing existing equipment capabilities by applying smart sensors to them. In process industries, the most critical assets are the rotating equipment, such as electrical motors, pumps, compressors and fans: these devices are designed to collect the fundamental data about the status and inject them into the infrastructure. Some smart sensors are specific for electric motors monitor the amount of energy flowing through a three-phase LV induction motor, the frame vibrations and the superficial temperature; other smart sensor measures the vibrations and temperature of the motor and load machine bearings. The data stream generated by sets of sensors are then collected by wireless gateways and

analyzed locally, this approach allows fulfilling two purposes. On one hand, it avoids to stream huge quantities of raw data to an external cloud environment, on the other side, it satisfy the need of oil, gas and chemical operators to maintain their critical information within the company IT infrastructure, choosing when and what to share with the service provider. This approach helps in the transition to true IoT industrial facilities. In this architecture, the key component to connect the field equipment, enable services and take advantage of service engineers' expertise is the software application that converts raw data into useful insights: the data analytics engine is a remote-enabled service delivery platform that allows users to view, scan and track important KPIs that affect equipment and process performance, so actions can be taken to improve site performance. By automatically collecting, analyzing and monitoring specific KPIs, the engine helps users make more informed decisions, resulting in improved availability, process efficiency and product quality, while reducing risk, raw material and energy costs. The KPIs generated for each machine cover different aspects of its health: process performance, electrical and mechanical condition, the health and performance of its control system, instruments and actuators. The entire fleet of monitored assets is displayed in a single dashboard page and the potential threats for the machine performance are aggregated in Process, Mechanical, Electrical and Control groups: this allows to the competent plant maintenance to investigate the issues related to their discipline, without losing a holistic overview of the machine status. Another important aspect of this application is the focus on predictive maintenance: instead of generating alarms when an asset fails, reports are generated providing forecasts regarding the residual lifetime of each machine, with a detail about which component is going to fail first. In this way, the maintenance and service engineers can take proactive actions to avoid catastrophic damages and losses of production. When a data analytics engine application is connected to a cloud infrastructure, the plant engineers can take advantage of global support from service company's service centers. The engineers in the service centers monitor the status of each connected device, diagnosing upcoming issues and helping the plant engineers to define the best strategies for a smooth and profitable site operation. Special attention is payed to ensure that all the communication between the site and the remote service centers are not impacting the safe operation of the plant and according the latest cyber-security regulations.