SMARTCrane Contributes to a Proactive Decision-Making and Optimization of Electrolysis Process

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Abstract

In smelters Pot Tending Machines (PTM) execute many and complex activities, such as anode change, tapping operation etc. Each anode change is a sequence of tasks: breaking the crust, gauging, traveling, scooping, anode placement and more. For one standard smelter it represents more than half million tasks to be executed correctly every year. To deliver production and ensure quality of aluminum, operations and maintenance teams face various challenges. Two major factors are: a full compliance with operating standards and very regular and respected workflow. These two parameters have a direct impact on the efficiency of the Aluminum process and operation stability. As well as on its environmental impact and greenhouse gas emissions, since, for example, poorly managed work can lead to over-consumption of anode. A IIOT solution SMARTCrane from Fives was implemented in various smelters and provided significant benefits for operations engineers and managers in taking proactive measures. Since it is running, it generated a vast amount of data and performance indicators. By analyzing this data and deriving actionable insights, operation and process teams made informed decisions regarding PTM availability and compliance with operating procedures. After several years of industrial use, this IIOT solution captured and analyzed worldwide more than 380 000 anode changes and made it possible to make a continuous control with loopback between the Key Performance Indicator (KPI) measured with operations and maintenance.

Keywords: Pot tending machines, IIOT field application platform, Overall equipment effectiveness.

1. Introduction

Many smelters have a wide range of equipment, layouts and processes with legacy devices, sensors, systems, and applications that span generations and periods. In addition, many of them likely use different operational technology providers for machinery, equipment lines and robotics technology. A smelter is mainly composed of machines, equipment lines and robots that are not always connected to the computer network.

The programmable logic controller (PLC), the monitoring and data acquisition system (SCADA) and the manufacturing execution system (MES) orchestrate the production flows and have demonstrated their contribution to the performance levels to be achieved.

The visible trend at the manufacturing level is to increasingly computerize the smelter's workshop; the convergence of operational and computer technologies is a reality. This creates

more possibilities for achieving a common global architecture encompassing multiple dimensions: equipment, edge, workshop, and cloud.

In such a context, SMARTCrane has been developed by Fives ECL as an innovative new concept of IIOT (Industrial Internet of Things) field application platform for operations and maintenance for PTM and Furnace Tending Assemblies (FTA) [1]. It relies on technologies that can include analytics, big data and industrial content. This paper presents the implementation and impact of this IIOT platform in smelter operations and how it can help to improve Overall Equipment Effectiveness (OEE). It highlights the role of data analytics in optimizing PTM performance, improving compliance with Standard Operational Procedures (SOP), and ultimately enhancing the efficiency and sustainability of aluminium production processes. The findings underscore the importance of leveraging advanced computing technologies to drive operational excellence and achieve environmental objectives in industrial settings.

2. People and Challenges in Smelters with PTM

In a smelter, there are different roles, or profiles, which contribute to overall performance and quality of production. Roles are linked to the concept of person. A person is a stakeholder in the system (platform IIoT) which is responsible for ensuring that KPIs are met.

The table of people and challenges is depicted in Table-1 below.

Table 1. People in pot room and challenges.

People	Role	KPI	Challenges
Potline manager	- Monitor and organize the daily operations of the Plant Pot Lines. - Supervise employees, the production and efficiency to ensure that the plant is operating regularly, quickly, effective, and safe.	- Safety - Budget - OEE - Productivity	- Time to upskill personnel - Collaborative interaction - Supplier relations - Easy access to information
Maintenance manager (scheduled maintenance)	- Ensure that the facilities, development, and the machines are working with a yield and a maximum efficiency. - This includes maintenance total preventive, management equipment failures mechanical, electrical and automation (including the software programming). - Management of people and reports budgetary and financial.	- Safety - Budget - Equipment availability time OEE - Completed task	- Limited time to complete the maintenance tasks - Cost pressure (optimal profitability)
Maintenance engineer/ planner (operational maintenance)	- Ensure the optimization of the maintenance organization structure. - Analyze equipment repetitive failures. - Estimate the costs of maintenance and evaluate the alternatives. - Assess the needs of replacement of the equipment and	- Safety - Equipment availability time OEE - Budget	- The diagnosis takes time because of the system complexity. - Missing spare parts - Administration and analysis cause downtime longer - Tedious process to find related information

8. Conclusions

IIOT filed application platform SMARTCrane serves as a critical tool that supports Smelter operations and maintenance by providing comprehensive monitoring and analysis.

Firstly, this system enhanced the quality of operation realization by meticulously tracking and evaluating the execution of millions of elementary tasks. This level of scrutiny ensured that operations adhered to strict standards, fostering consistent quality and reliability in anode change processes.

Secondly, the system contributed to equipment availability by conducting detailed analyses of sub-functions and detecting performance degradation. This proactive approach enabled timely interventions to maintain equipment uptime and reliability, ultimately optimizing operational efficiency [1].

Moreover, the insights gained from the solution facilitated transparency between customers internal departments operations and maintenance. By uncovering previously unseen details and performance metrics, this collaborative effort led to informed decision-making and continuous improvement initiatives.

9. References

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