Smart Cranes at Emirates Global Aluminium

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Abstract

This paper explains the journey of transforming existing cranes to Smart Cranes in one of EGA's potlines. This in-house development has improved Reduction's operational and crane maintenance performance. Smart Cranes enable the tracking real-time crane locations from the Supervisor control room. The system is equipped to monitor crane activities and compliance to Standard Operating Procedure (SOP) with alerts and voice alarms through EGA's Pot Control System. Work completion status against schedule is updated in real-time dashboards to assist better shift planning and achieve planned jobs on time.

Smart Cranes have improved the quality of jobs and resulted in lower rework, such as anode position adjustment and anode setting quality related to anode problems. They contribute to improved shift performance as all data is directly fed into the Performance Management System (PMS) of the potline. The system is programmed to estimate the life cycle of crane tools and equipment and triggers alarms at given threshold limits to enable prompt changeover. This improves crane availability and increases the mean time between repairs (MTBR). The system can evaluate its own budget for a given year, based on the inbuilt predictive analysis tool. This paper is a synopsis of the Smart Cranes project, which can be used by smelters and crane manufacturers worldwide.

Keywords: Smart potlines, Smart cranes, Crane maintenance, Standard operating procedure.

1. Introduction

Emirates Global Aluminium is the world's largest 'premium aluminium' producer and the biggest industrial company in the United Arab Emirates outside oil and gas, producing 2.653 million tonnes of aluminum in 2022. The company operates a bauxite mine, an alumina refinery and two aluminium smelters. In the two aluminium smelters, located at Jebel Ali and Al Taweelah, EGA operates seven cell technologies, developed inhouse since 1990, given in Table 1.

Table 1. EGA smelting technology and installed production capacity.

Smelter and Location	Technology	No of Cells	Production Capacity
Jebel Ali, Dubai	CD20, D20, D18+, D20+, DX, DX+ Ultra	1576	1.1 Mt/y
Al Taweelah, Abu Dhabi	DX, DX+, DX+ Ultra	1262	1.5 Mt/y

Aluminium electrolysis is carried out in cells connected in series to form a potline. The work practice in potlines is repetitive on cell-to-cell basis and shift-to-shift basis. Each shift crew follows the same jobs patterns. Potroom cranes, also called pot tending machines (PTMs) are used for many operations, such as anode change, anode covering with anode cover recycled material (ACRM), metal and bath tapping, etc.

The Smart Cranes project was undertaken with the goal of achieving 100% SOP compliance for scheduled operational activities, and to improve the process. Any deviation in the scheduled activity and its SOP is recorded and shared with the team to improve compliance. Process improvement enhances operational stability, contributing to better KPI performance, such as current efficiency (CE) and lower anode problems.

The Smart Cranes system provides visibility of crane activities in real time to supervisors, and any deviation from the planned activity and its practice is flagged in the Smelter Analytics iPOTs screen, which is continuously monitored by the shift supervisor. The Smart Cranes manufacturing execution system (MES) provides information on work progress through the Power BI report to the shift supervisor, and monitors the corrective actions on unstable and abnormal cells, so that he or she can do better shift planning. The system is designed to highlight non-compliant activities with alerts and voice alarms for corrective action. Individuals can check and analyse shift performance at any given point of time for year to date (YTD) and month to date (MTD), and this is recorded in the Performance Management System to evaluate team performance.

2. Background of Smart Cranes and the Reasons for Developing the Application

Artificial intelligence (AI) and Industry 4.0 creates opportunities for improved performance across manufacturing. The Smart Cranes project was one of many projects to harness the power of AI and Industry 4.0 at EGA. The five main drivers for the trial were:

- The required data is already available in multiple locations on our system.
- The team had the capability to migrate this data to a single location for analysis and programming.
- Data has the potential to be processed into valuable insights that could be beneficial for the operations and maintenance.
- The infrastructure needed for the entire project could be installed in a reasonable time.
- The infrastructure would be able to combine all the operational activities of a potline and crane maintenance as well, so that all the aspects can be studied and maximum benefits extracted.

A cross-functional team was formed for the Smart Cranes project with clearly defined scope and timelines. Figure 1 shows the structure and scope of each part of the team.