CASE STUDY

COMPANY

LIEBHERR

Liebherr is one of the worlds largest manufacturers of construction machinery. As one of the first Liebherr companies outside Germany, Liebherr Container Cranes Ltd. was founded in Killarney in the southwest of Ireland in 1958.

The company now develops and produces ship-to-shore container cranes, rubber-tied and a rail- mounted stacker cranes, and accessories at its Killarney site. It has a workforce of 810 people.

LIEBHERR

Liebherr Group

@Liebherr

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GOAL

PROJECT GOAL

The top-level goal of this work was to examine recorded Ship to Shore (STS) and Rubber Tyred Gantry (RTG) crane sensor data with a view to seeing what could be achieved in relation to energy harvesting and preventative maintenance solutions. Thus, the focus of this project was to develop an automated machine learning approach, capable of delivering data driven statistics, to provide early warning indicators of potential failures or crane maintenance requirements. Parameters reviewed included a scrutiny of the duty cycle of the electrical motor in practice versus that of the its rated specifications.

As the cranes stalwart motor and that being most prone to failure within the RTG and STS systems, data from the hoist motor was paramount in determining any possible points of failure. In addition, the data analysis effort evaluated the temperature performance of each of the motor windings over a sustained time period.

CHALLENGES

PROJECT CHALLENGES

Program challenges included the cleansing and pre-processing of the extremely large volume of data in this instance - formatting sensor output data recorded hundreds of times per second from the motor control unit. Typically, a 24-hour period would record in the region of 4.2 million data items. Furthermore, any given disposition of the motor is determined by the state of multiple sensor output levels and their respective prior transitions.

HOW

PROJECT SOLUTION

This project succeeded in developing a machine learning algorithm to extract key performance metrics pertaining to the duty cycle of RTG and STS hoist motors. The results for this project are based on the analysis of operational trace data provided by Leibherr. Thus, this effort involved the use of algorithms to monitor signal transitions as well as signal levels and summarize these over key sustained timeframes. It was found that over the select periods examined - the duty cycle specifications of the hoist motor appeared to be exceeded both on average and for a multitude of time periods of operational activity. This research also enabled a detailed extraction of parameters per active time of the motor, such as temperature. Intuitively, with further analysis, this could potentially enable the ability to flag deterioration within a motor winding before failure occurs.

IMPACT FOR THE COMPANY

This proved the feasibility of developing an anomaly detection system for key hoist motor within RTG and STS crane units through ongoing summarization and calculations of available sensor data. This would also provide the basis for applying machine learning techniques to prediction of events going forward.

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WHAT OUR CLIENT HAS TO SAY

CLIENT TESTIMONIAL

"The Nimbus Research Centre did a good job in facilitating a research exercise of a relevant dataset that has recommended a suitable anomaly detection algorithm. We are very happy with this result. We will be interested to further explore possible areas where anomaly detection can have a big impact."

Dr. John Barry, Principal R&D Engineer, Liebherr