



Predictive Asset Analytics to Improve Mining Operations



Overview

In any asset-intensive industry, organizations strive for optimal performance at all times. They want to limit downtime, control costs, and minimize safety and environmental risks while achieving maximum productivity. In the mining segment, the goals are not much different. With a number of challenges facing the industry, mining organizations must take every opportunity to improve. They cannot rely on traditional operational approaches to achieve new outcomes in today's marketplace.

One opportunity to drive positive change in mining operations has been created through the exponential growth of industrial data and analytics. Organizations can leverage this data to improve performance and efficiency through investments in condition monitoring and predictive analytics solutions. These solutions provide real-time information on the health and performance of critical assets, giving personnel the insight needed to make timely and informed operational and maintenance decisions.

Moving to Proactive Maintenance

Because mining operations require a diverse set of complex assets, many of which are mobile or in remote and hard-to-access locations, monitoring equipment health and performance can be a significant challenge. Compressors, generators, pumps, fans, blowers, heat exchangers, boilers, ovens, kilns, pulverizers, crushers, gearboxes and condensers are just some of the many assets that can be monitored using sensor data. This asset health data can be used in maintenance programs to mitigate risks and ensure that critical equipment is operating as expected.

A comprehensive maintenance program includes several approaches that are appropriate for various types of equipment. The most basic approach, reactive maintenance, involves letting an asset run until failure. It is only suitable for non-critical assets that have little to no immediate impact on safety and have minimal repair or replacement costs so that they do not warrant an investment in advanced technology.

On the other hand, preventative maintenance (PM) approaches are implemented in hopes that an asset will not reach the point of failure. The preventative maintenance strategy prescribes maintenance work to be conducted on a fixed time schedule or based on operational statistics and manufacturer recommendations of good practice. Preventative maintenance can be managed in the Enterprise Asset Management or CMMS system.

A more proactive approach, Condition-based Maintenance (CBM) focuses on the physical condition of equipment and how it is operating. The condition must be definable using rule-based logic, where the rule does not change depending on loading, ambient or operational conditions. For example, a condition management solution could automatically trigger a work order to replace a pump filter if the pump inlet pressure drops below a specified pressure.

For more complex and critical assets, a predictive strategy is appropriate. PdM relies on the continuous monitoring of asset performance through sensor data and prediction engines to provide advanced warning of equipment problems and failures. PdM typically requires a predictive analytics software solution for real-time insights of equipment health and performance.

Predictive Analytics

Using a predictive analytics solution in conjunction with other maintenance techniques can lead to the identification of issues that may not have been found otherwise. According to research by ARC Advisory Group, only 18 percent of assets have a failure pattern that increases with use or age (Rio, 2015).



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This means that preventative maintenance alone is not enough to avoid failure in the other 82 percent of assets and a more advanced approach is required. Predictive analytics software uses historical operational signatures for each asset and compares it to real-time operating data to detect subtle changes in equipment behavior. The software is able to identify changes in system behavior well before the deviating variables reach operational alarm levels, creating more time for analysis and corrective action.

Although the number of companies taking full advantage of predictive maintenance is growing, the proportion remains relatively small. For many potential users, the complexity and cost of these systems has been an obstacle. However, as technology continues to advance, the price of sensors and other smart devices continues to decrease. In addition, some advanced predictive analytics solutions do not require special instrumentation. Instead, they rely on existing sensor data for input into the modeling and predictive process.

Avantis PRiSM Predictive Asset Analytics

Predictive asset analytics software solutions support PdM and improve performance by providing early warning notification of equipment issues and potential failures. Schneider Electric's Avantis® PRiSM software is based on a proprietary algorithm that uses Advanced Pattern Recognition (APR) and machine learning technology. Existing machinery sensor data is input into the software's advanced modeling process and compared to real-time operating data to determine and alert upon subtle deviations in equipment behavior. Once an issue has been identified, the software can assist in root cause analysis and provide fault diagnostics to help the user understand the reason and significance of the problem.

When implementing a predictive asset analytics solution, the user first identifies which assets to monitor based on criticality, equipment history and site goals. Implementation can be conducted in phases, and assets that have had continuous problems, directly impact availability or are likely to have a quick return on investment may be the first to be monitored. Solutions can vary widely in complexity and difficulty, which has been a challenge in mining, however PRiSM is an intuitive system designed so that the user can easily configure it to monitor different types of equipment.

Benefits of Predictive Analytics

Avantis PRiSM enables personnel to address subtle variations in equipment behavior before they become problems that significantly impact operations. Unscheduled downtime can be reduced because personnel receive early warning notifications of developing issues. PRiSM can identify problems days, weeks or months before they occur, creating time for personnel to be proactive.

Maintenance costs can also be reduced due to better planning; parts can be ordered and shipped without rush and equipment can continue running. Additionally, some suggested maintenance windows can be lengthened as determined by equipment condition and throughput and recovery can be maximized. Other benefits include increased asset utilization and the ability to identify underperforming assets.

The PRiSM Advantage

- 1 Reduce Unscheduled Downtime
- 2 Prevent Equipment Failures
- 3 Reduce Maintenance Costs
- 4 Increase Asset Utilization
- 5 Extend Equipment Life
- 6 Identify Underperforming Assets
- 7 Improve Safety

Not only do companies reduce expenses by extending equipment life, lengthening maintenance windows, and increasing asset availability, other savings are realized when considering the costs that “could have been,” including replacement equipment, lost productivity, additional man hours, etc., when a major failure is avoided. PRiSM transforms raw data into easy-to-understand and actionable insights to help personnel further improve decision-making. For example, PRiSM could be used to determine why a haul truck is experiencing high engine temperatures before the engine suffers excessive wear or failure. Subtle changes in bearing and oil temperature can be identified to avoid damage to a gearbox or any of its components.

With PRiSM, personnel know and understand the actual and expected performance for an asset’s current ambient, loading and operating conditions. They know where inefficiencies are and their impact on financial performance and can use this information to understand the impact of performance deficiencies on current and future operations. This information also helps users assess the risk and potential consequences associated with each monitored asset and can be used to better prioritize capital and operational expenditures.

Another increasingly important benefit is the capability for knowledge capture and transfer. PRiSM ensures that maintenance decisions and processes are repeatable even when organizations are faced with transitioning workforces.

Conclusion

Predictive analytics and condition monitoring solutions help mining personnel take advantage of the massive amounts of data available today and use it to make real-time decisions that have a significantly positive impact on throughput, recovery, equipment reliability and availability. PRiSM provides early warning detection and diagnosis of equipment problems to help personnel work more effectively by providing early warning notification and allowing more lead time to plan necessary maintenance, ultimately avoiding potential equipment failure and improving performance.

Mining organizations can move from reactive to proactive maintenance by leveraging condition monitoring and predictive analytics solutions to spend less time looking for potential issues and more time taking actions to get the most out of every single asset. Companies can monitor critical assets, both fixed and mobile, to identify, diagnose and prioritize impending equipment problems – continuously and in real time.

References

1. Rio, Ralph (January 2015). “Proactive Asset Management with IIoT and Analytics,” ARC Advisory Group Retrieved from: <http://www.arcweb.com/Blog/Post/260/Proactive-Asset-Management-with-IIoT-and-Analytics?cldee=Y2h1ZHNvbkBpbmN0ZXBzb2Z0d2FyZS5jb20%3d>.



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