Seven Trends for the Future of Mining Automation

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Introduction

Mining is a complex industry. Extracting raw material in different shapes, sizes and chemistries from the earth’s crust and transforming it into a standardized and high quality final product is a challenging process. Not to mention that it involves huge material movement, scheduling, synchronization and tracking — all on a large scale. It’s like a manufacturing plant but with no tagged boxes.

Automation plays an important role in the mine environment. However, for the majority of those in the mining industry, automation is a much larger concept than regulatory systems, supervision and instrumentation. Automation can cover the geological/geographical information systems software to autonomous machines, and from mine execution software to optimization or expert systems.

As automation in the mining world evolves, there are seven trends that likely will help shape its future.
Seven Trends for the Future of Mining Automation

**Trend 1:**

Using information systems to achieve data integration and customized user aggregation

In some mining operations there can be an excess of information. A myriad of dissimilar and sometimes proprietary systems, such as process control, ERP, MES, laboratory information management system (LIMS), process information management system (PIMS), quality control, asset management, fleet management, geographic information system (GIS) and energy management systems are delivering tons of data that can be useless if not treated, filtered and integrated in a meaningful way.

When not properly connected, these applications make more work through isolated databases, and duplicate data and spreadsheets. Then manual entries or custom homemade software (middleware) is required to interface among the applications.

To combat this dilemma, mining operations are moving to IT solutions and architectures to integrate dissimilar applications in a proper way to achieve common information, centralize data and better data exchange and orchestration. In addition, individual vendors’ systems need to be friendlier and use open standards so information is accessible.

Mine information integration and orchestration from different data sources
Customized user aggregation

Using data aggregation, a production manager is able to customize his/her personal computer screen to show energy efficiency information, particle size, grade, cost and emissions. All he/she needs to do is drag and drop the KPIs, reports and trends that are important for his/her current needs, even if the information is coming from different sources and layers.

In a higher level, a plant manager can aggregate and visualize even more information, not necessarily limited to process information. Energy and utilities consumption from the office buildings, along with IT and processing units can be aggregated in a single screen. Basically, users can customize their screen with information relevant for their needs from all available data sources.

Some users have the energy consumption information, that is not cross-referenced with production information. Other users cannot identify the difference between overconsumption generated by legitimate process requirements from overconsumption caused by problems or under performance.

A production manager will be able to customize his/her personal computer screen to aggregate data that is important for his/her current needs.

Trend 2:

Energy as process variable: solving the lack of integration between plant information and energy information

Users need a deeper understanding of how energy is used and the ability to identify the drivers and root causes for increased energy consumption per unit of production. This understanding requires timely access to accurate energy information, as well as the operational context of how that energy was used.

In these situations, energy forecasting is challenging since there is no single, complete model about how energy has been used.

For many years it was very common for energy and process control to be managed by two separate departments — classic information silos with no connection or combined analysis. Today, however, it is almost impossible for the two not to be linked since energy efficiency is intrinsically tied to process control optimization. Physical and data integration between production, control and power allows users to link process performance with energy management, quality and efficiency. Energy information also can be used for online process optimization.

The takeaway is that it’s important to have online energy efficiency information in a process context. This also allows operators to manage energy consumption and its costs, as well as evaluate the impact of their decisions — a perfect integration between power and control systems.
Seven Trends for the Future of Mining Automation (cont.)

Trend 3:

Internet and Ethernet technologies in the field

Useful data from field and control systems can have a transparent route to the production and business application layers of a mine operation and become an important source of information to minimize data entry, retyping and even mistakes. Most importantly, the information is coming from the actual process.

Devices including instrumentation, online analyzers, motor control, and dedicated devices such as weighing and gas emissions, that are linked to Ethernet networks allow users to obtain data, visualize, configure and maintain these devices in a wider plant approach — not restricted and isolated by process area. Embedded web servers allow users access to monitor and configure devices, simply by using commercial web browsers. An open industrial Ethernet network saves users proprietary software costs and offers more intuitive tools. This technology also allows users to customize their device “home page” according to their requirements. An email server notifies users if something goes wrong or if variables are at a critical level.

At the plant level, Ethernet and internet technologies permit remote plant access, down to the device level, so isolated mines can be monitored and even maintained.

Trend 4:

Centralized operation and monitoring

An up-and-coming concept in mining operations is the use of a central, virtual control room. The central control room monitors several mines in distant locations from a single location. Central control rooms, for example, can monitor all energy consumption from different units and compare the performance among different plants down to the equipment level and loads, all from a single location. From a business perspective, this facilitates benchmarking and comparisons of the same processes at different plants.

An advanced concept of virtual control rooms includes a user who outsources remote monitoring to another company and the technology supplier manages the user information and historic data in virtual servers.

Trend 5:

Wireless

For years, radio communication has been used in the mine environment, for example stacker reclaim machine communication, remote pump systems in isolated locations or fleet control communications. But the world is becoming more and more wireless and the next logical step for this proven technology is industry and the plant floor.

Wireless sensors, RFID material and personal tracking, condition monitoring and data acquisition are all becoming more common and finding applications in the mine industry. Some mining companies have tested tags that are blended with iron ore pellets for traceability purposes. In addition, wireless technologies are migrating to instruments and device networks for a more efficient monitoring and asset management strategy.

These types of wireless technology applications are “safe ground.” However, wireless is facing two big challenges in technology consolidation and process control.

Like the fieldbus “wars” several years ago, a similar battle is being waged between wireless technologies. In addition to performance and safety, users are waiting for standardization and technology definitions.
Different technologies and competition between vendor associations means that users aren’t fully confident and are avoiding making investments until the technology is fully accepted and consolidated.

In addition, the natural path for wireless technology is to use it to operate instruments and motor control centers, thereby minimizing all the inconveniences that cable brings to these applications. However, the use of wireless technology for loop control and critical interlocking still causes concern for users.

**Trend 6:**

**Autonomous systems**

Mining companies are doing serious investigation into autonomous equipment and machines, such as trucks, excavators, etc., both for safety and efficiency reasons. The technology can range from remote operation and semiautomatic operation, to a complete autonomous system with virtually zero human involvement.

The biggest challenge is not just for the equipment to be completely autonomous, but to devise a system that involves the simultaneous movement of multiple autonomous machines, all operating together in a coordinated way while following a schedule and maintaining proper position and safety measures to avoid collision. In addition, the entire system must be intelligent and capable of adapting to production changes and unexpected events.

**Trend 7:**

**Image and video as process tools**

Until now, cameras systems and video surveillance are associated with people and asset protection. However, they can be applied in a mine environment beyond conventional surveillance to automatically identify equipment that is missing parts, sizing, fragmentation, tracking and thermal profile. Image and video solutions will be driven by better integration of powerful video analytics and cameras systems in automation tools such as process controllers, supervision systems, etc.
Evolving Operations

These seven technologies are a snapshot of how automation will contribute to advance mining operations. Properly integrated automation technologies, combined with an evolution in extracting and refining technologies, certainly will help users be more safe, productive, cost efficient and environmentally friendly.

About the Author

Fabio Mielli is the U.S. mining, metals and minerals segment manager for Schneider Electric. An electrical engineer, Mielli has been with Schneider Electric for 16 years and is based in Georgia. He has 20 years of experience in speed drives, automation, and industrial control, and has worked closely with the major mining and metals producers. He can be reached at fabio.mielli@us.schneider-electric.com.