Spotlight on Trends: Data-Driven Machine Monitoring

Improving the bottom line remains a high priority. Managers focus on continuously increasing production efficiency and reducing waste. In this age of increasing industrial automation, data-driven machine monitoring is gaining traction in identifying cost savings opportunities. This is because the number of software applications communicating in real time with production floor machines has increased as companies scale up their operations. Yet, this also makes the process of monitoring machine performance tremendously complex because of the potential data incompatibility across machine applications. This data incompatibility between machines becomes a roadblock to evaluating how the machines are actually performing. An increasingly utilized technology developed by industry leaders to address this compatibility issue, allows data from multiple machines to be reported in a universal language. Below we share one company’s results from implementing this technology.

Basic Concepts

Manufacturers need to monitor not only operations productivity, but also perform a root cause analysis of gaps between actual performance and expected or target performance. Key data metrics that shop floor supervisors monitor and measure include Overall Equipment Effectiveness (OEE) and Total Effective Equipment Performance (TEEP). These two metrics are closely related, and are often used to determine the overall machine utilization efficiency (See Figure 1).

Figure 1: OEE and TEEP Summary

| Overall Equipment Effectiveness (OEE) = (Availability)*(Performance)*(Quality) |
| Total Effective Equipment Performance (TEEP) = (OEE)*(Loading) |

Availability = Percent of scheduled time that the machine is available to operate (also called uptime)
Performance = The speed at which the machine runs as a percentage of its designed speed
Quality = Good units produced as a percentage of the total units started
Loading = The percentage of calendar time scheduled for operation

Many machine tools today are equipped with sensors that generate significant amounts of real-time performance data. By monitoring and analyzing this data, management is able to identify the process bottlenecks and other problems that disrupt factory operations. For example, analysis of the data on machine speed, temperature and volume processed allows management to predict the best time and frequency to replace worn parts. This practice ensures the manufactured item is produced within the desired specifications.

Beyond the Basics

While the importance of machine monitoring seems obvious, it is not an easy task. The challenge is associated with the operational scale and increasing complexity of data exchange required. Different machine tools usually speak different native languages (sometimes called firmware), which means software applications must be able to process the data in multiple forms to generate useful business intelligence. As more machines
are installed, the communications web between equipment and applications becomes so complicated that companies find it extremely difficult to capture, aggregate and make use of the data.

One trending technology to address this issue is MTConnect™, an open, royalty-free standard that was developed by industry leaders through the MTConnect Institute (a subsidiary of the Association for Manufacturing Technology) to foster greater interoperability between equipment, accessories, applications, and devices in the manufacturing industry. The standard translates various machine ‘languages’ into a universal language allowing applications to retrieve and process the common-format data (see Figure 2). In the end, it enables the integration of all machines, which makes monitoring them feasible.

![Figure 2: Information Flow](image)

Some manufacturers are already selling products that are MTConnect™-enabled. For those that do not, hardware and software adaptors can be embedded into controllers or installed externally to function as a translator.

The vision extends beyond a single manufacturing facility because manufacturers may have the ability to link all facilities worldwide into one network. This ensuing capability to store and analyze massive data provides valuable information capabilities for companies to view from a high level, and drive savings to the bottom line.

**Tangible Results**

Mazak’s North American Headquarters and Technology Center in Florence, Kentucky installed an MTConnect™-enabled machine monitoring system on 15 machines. From the implementation in November 2013 through the first quarter of 2014, Mazak reaped significant benefits:

- Improved utilization of the monitored machines by 17%
- Uncovered easily fixed inefficiencies and practices
- Identified root causes of machine stoppages
- Improved replacement parts management

**For More Information**


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