MITSUBISHI ELECTRIC
Changes for the Better

5 Smart Machine Trends You Need to Know

WHITE PAPER

Design Considerations for Smart Machines

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OEMs adopting smart machine technologies look to Mitsubishi Electric iQ platform controllers and intelligent servos to provide connected visualization of performance and analytics.

EXECUTIVE SUMMARY

The last 10 years have brought about dramatic advances in technologies that OEMs had never realized would affect their designs or the sellability of their machines, much less impact business models and profits so dramatically. Standardization of network adoption across manufacturing operations, and convergence with office and operations systems have proliferated the need to enhance information flows from production machinery and warehouse operations while improving the performance, intelligence, and communications of individual components. The following discussion will cover key advancements and recommendations all OEMs should be adopting in their design processes to stay current and competitive.

THE MANUFACTURING LANDSCAPE IN FLUX

Several trends have impacted production operations over the last decade, creating the need to enhance automation systems to accommodate a changing global landscape.

The aging of manufacturing workers and the lack of qualified replacement workers coupled with globalization and automation adoption has pushed the envelope of human resources to fill ever more technically demanding roles to augment ever more technically complex machinery.

The recent rise of common IT technology adoption to operations systems, previously explicit to automation vendors, has presented manufacturers with challenges in both human resource management as well as capital expense deployment. OEMs must now adopt information technologies and intelligent sensing as part of their designs to meet customer needs to monitor the effectivity of their assets. Logistics efforts now require intense coordination of IT based tracking solutions coupled with autonomous controlled material handling machines to satisfy next day deliveries and shifting consumer demands.

At the same time, open technologies have exposed vulnerabilities to both internal and external threats in cyber or physical worlds. Security and safety challenges have increased in complexity and future proofing against unknown threats is a critical design criteria for OEMs today.

So how do OEMs respond with smarter machines to ensure higher levels of value to their customers while navigating more complex technology requirements?

These 5 innovations create a foundation for improving machine intelligence and desirability while offering the added benefit of reshaping your business models for enhanced revenue streams and cost containment.

1. Things on the internet aka: IoT – Improve revenue and service margins

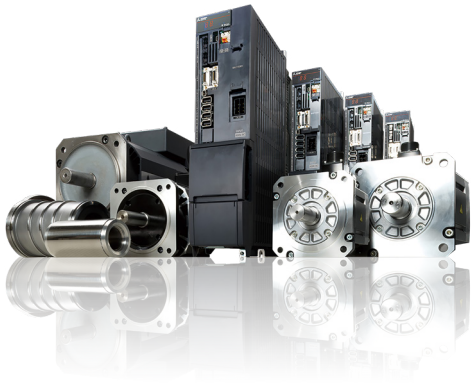
While the common catch phrase for internet intelligence seems to captivate a lot of press, it comes down to a simple application of Moore's law. As ethernet chipsets have increased in processing capacity, the price has come down to a point where every industrial sensing or actuating device has inborn capability to communicate and process information. This has created a generation of devices that can be reconfigured, monitored, diagnosed and potentially repaired using mobile and remote devices. OEMs who effectively deploy intelligent devices inherently give themselves a margin saving advantage as this intelligence does several things for them:

- Provides real time diagnostics and potentially predictive analysis
- Provides real time feedback on potential failure modes of the machine and deployment of spare parts – more efficiently to mitigate unnecessary parts stores and cash flow
- Provides the foundation of intelligent machine parameters to accommodate shifts in consumer demand or quick turn retailer inventory requirements
- Improves global competitiveness and potential new revenue streams as information is processed downstream

Mitsubishi Electric servos have built-in analytics that monitor performance of the attached load and operate in a continuous tuning mode to ensure optimum performance at all times. Mobile technology expands and empowers logistics operators, managers and supervisors to make timely decisions no matter where they are.

2. Analytics become mainstream

Not long ago, analytics were the domain of Big Data players and super computer houses. While these players still hold relevance to major users and producers, many sets of information require more immediacy and cannot tolerate the latency of uploading and processing these players require. Analytics are now available in small footprints and are built directly into products, allowing fit for purpose analytics to relay critical behaviors in real time. Many vendors are now pursuing the small analytic engine model to provide immediate diagnostics and repair information to the user as well as report back to the OEM so that any potential downtime is minimized or eliminated.



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Using analytic data from a fleet of installed machines provides the OEM aggregated feedback on failure analysis, vendor performance, and customer utilization. It also provides a window into the machines' actual utilization so that improvements and evolution, or remote upgrades become revenue enhancements for the future.

For material handling applications, on board analytics can be helpful in maintaining runtime and improving cycle times. Utilizing on board analytics in real time provides high response tracking and sorting, adaptive tuning to accommodate longer run time in suboptimal conditions and algorithms designed to prevent sway or vibration induced by loads or mechanical deterioration.

3. Remote monitoring through cloud services

More end users have adopted cloud based services as a means to contain the costly IT support and capital expense required to process the proliferation of data in their systems. As a result, security practices have matured and OEMs can have access to their machine data and related production information through judicious accessibility. OEMs have created standard monitoring capabilities to advise their customers of impending mechanical or operator issues, safety concerns, and production anomalies. Typically control vendors are providing preconfigured diagnostic screens on their HMIs in order to advise operators of fault or alarm conditions, and in parallel, advise the OEM of the need for parts or service.

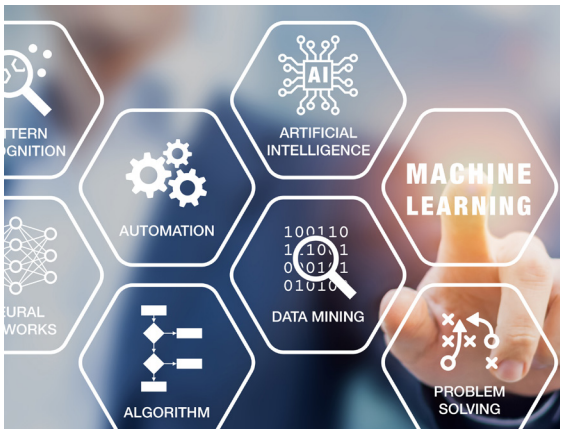
OEMs can gain an added benefit in using remote monitoring services to adapt their business models. For example, knowing the behaviors, attributes and the utilization characteristics of a fleet of machines can provide useful insight in the evolution of machine designs, upgrades for users, and off site remote services such as maintenance monitoring and repair requests. Similarly, fleet monitoring provides a window to part failures, spares requirements, and analysis of inventories to ensure only required spares are inventoried locally – reducing carrying costs and improving delivery times.

Machine learning diagnostics compensate for vibration and friction. This information is displayed on GOT operator terminals and remotely.

Mitsubishi Electric offerings include integrated robotics, servo and PLC programming from a single software package, modular code templates and mechatronics estimation tools.

4. Machine learning

Smart machines take advantage of vendor technologies and aggregate the learnings from individual sensors and components into algorithms that mitigate downtime and provide prognostic and predictive diagnostics. These machines provide enhanced value to the end user through improved OEE and optimized availability. Further, as conditions on the machine change over time – due to mechanical degradation, product changeovers or operating conditions, these algorithms auto-tune and auto-correct to retain performance and availability while providing diagnostic information, and alarms to appropriate personnel.



The ability of individual components to monitor and correct aberrant behaviors is critical to running production at full speed with less operator intervention, and less lost production and downtime.

When dealing with high speed sortation, warehouse operations and ASRS systems, precision under variable load and mechanical conditions is critical to cycle times and delivery performance. Machine learning, scaled down to control component levels provide optimized OEE and efficiency.

5. The rise of robotics

Forecasts call for the number of industrial robots to rise exponentially for the next 10 years and its easy to see why. As mentioned above, human resource constraints, technical sophistication and faster sortation and handling speeds predicate assistance from robotic elements. In some cases, robotics augment and collaborate with human co-workers, and in others, perform highly repetitive and precise operations in dangerous environments. Robotics have become safer and more versatile as smart sensor technologies have advanced. More material handling OEMs consider robotics a critical part of their next generation designs and look to specialized vendors to work closely with automation integration, information management, and operator workflows to ensure optimized throughput and safety. Importantly, the automation system and robotic system should be tightly coupled in programming and configuration in order to maximize engineering efficiency and longer-term maintenance issue.

BRINGING IT ALL TOGETHER

Smart machines will require less human intervention for runtime and maintenance, improve overall availability and production efficiencies, and integrate easily with business systems to ensure demand is met just in time, and is integrated tightly with supply chain management objectives and systems. Users faced with increasing margin pressures, operator skill challenges, and the impact of immediate demand requirements are increasingly expecting integrated smart machines to ensure demand is met, quality is guaranteed, and losses are minimized. Working with automation vendors that innovate with these smart machine technologies will provide OEMs assurance that their designs will be competitive and improve their customer service longer term.

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