GOT Mobile webserver allows users to stay connected to the machine from up to 5 simultaneous remote locations.

New OEM business models emerge

OEMs have realized that newer digitalized offerings provide the user beneficial runtime enhancements and ongoing runtime. Connecting to remote experts at the OEM provides feedback on maintenance and parts availability.

Advanced OEMs have fleet management operations capable of accumulating usage data form a wide population of machines, stored to the cloud and analyzed for aggregate failure modes, wear items, and usage of consumables. Knowing these things about the fleet as well as the user operating characteristics provide invaluable information for improving production quality and uptime for their machines.

Advanced analytics from fleet diagnostics can provide OEMs with unique opportunities to consider their structured costs for servicing the fleet. Specifically, carefully monitoring the failures of components can provide insight to future design enhancement while providing insights to spares stores – mitigating carrying costs for unnecessary parts storage particularly in remote geographies. Further, knowing the nature of likely component failures or operation shortcomings can provide more efficient servicing capabilities. Whether utilizing in house experts or contracted services, lowering the cost to service remote machines is vital to improving profitability through just in time service and maintenance instead of just in case preventive measures.

Remote access through services such as @ FactoryCloud offers you and your customers convenient access to critical machine information.

As Remote monitoring and predictive maintenance gains critical mass in the market, OEMs will also be utilizing software upgrades and remote upgrade techniques to enhance their revenue streams and improve the user's usability and flexibility. In some cases, particularly for OEMs with consumables as part of their revenue models, utilization of materials can be monitored for automatic restocking, pre-production planning will provide the OEM with advance ordering of new consumables and users will benefit from just in time deliveries and immediate demand fulfilment. All of these OEM business models require platforms capable of remote monitoring in a secured network environment.

While the advancements in machine learning and fleet management appear promising, there is always a lingering concern around security practices from remote monitoring or remote enhancements. It takes a high degree of network and control system security competence and diligence to ensure any remote device interaction with a machine or line cannot infect the overall system, damage equipment or harm operators. These concerns have traditionally stymied OEMs from getting access to user equipment once deployed. Newer security practices and enhanced firewalls, OEM security measures and collaborative relationships with user IT groups are gradually opening possibilities for OEMS to enhance their offerings, share cloud data with users and offer secure upgrade paths for better performance.

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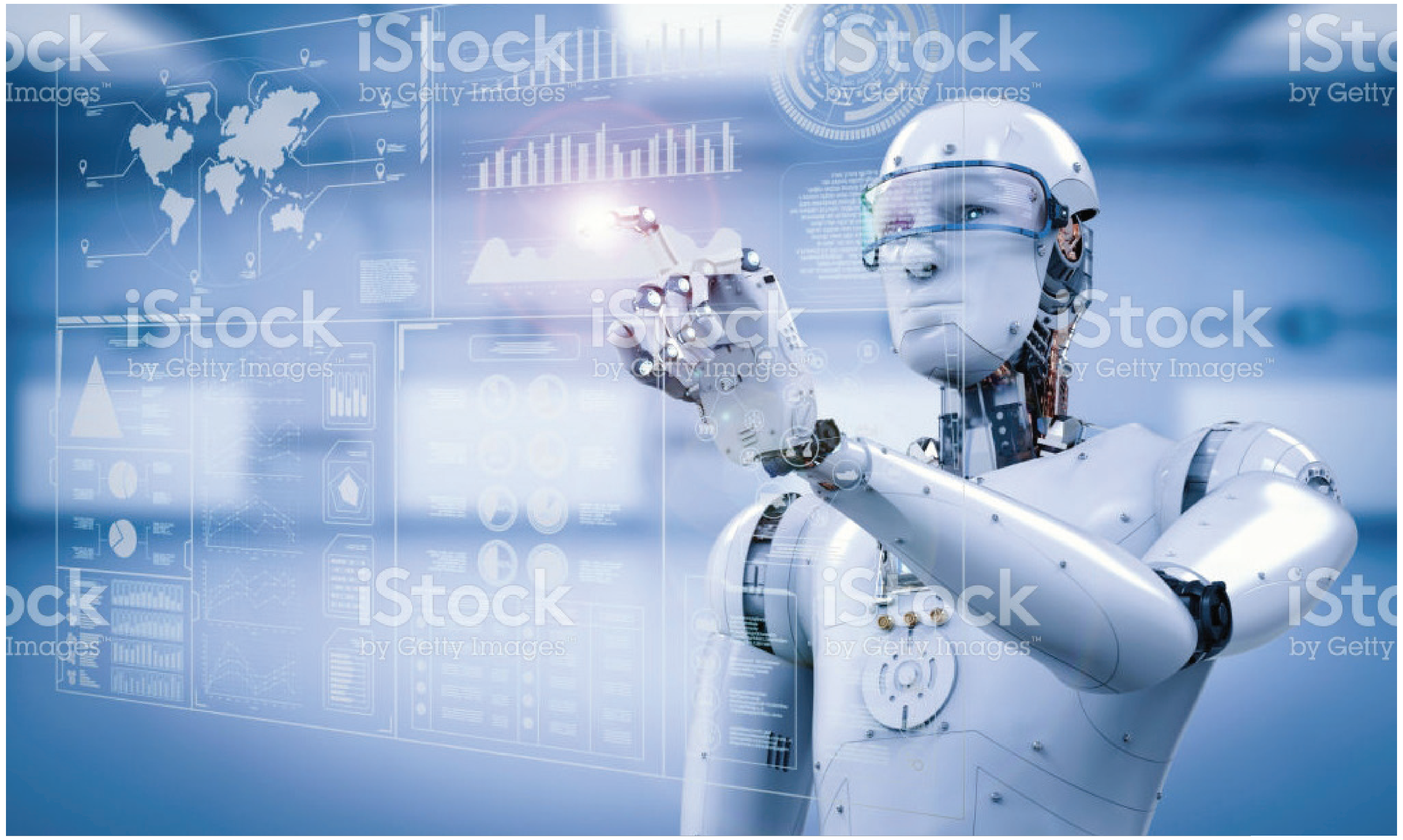
Innovative Predictive Maintenance Capabilities for Packaging Operations



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Innovative Predictive Maintenance Capabilities for Packaging Operations

Executive summary:
The convergence and adoption of IT technologies with automation systems has produced a number of innovations appropriate for OEMs in order to lower their total cost to deploy and service their fleets. Many of these innovations are grounded in the adoption of networking and security technologies that provide instant communication to operators and managers about the quality of production and the availability and effectiveness of the machines responsible.

As more packaging lines are integrated from front to back end, processes and machines are linked together to form a connected and digitized value chain with visibility to every aspect of machine performance, operator effectiveness and production throughput and quality.

OEMs are now reaching for more innovations, including the use of cloud, AI and machine learning that allow them to lower their cost to deploy and service their packaging customers while improving their response times and providing operational improvements.

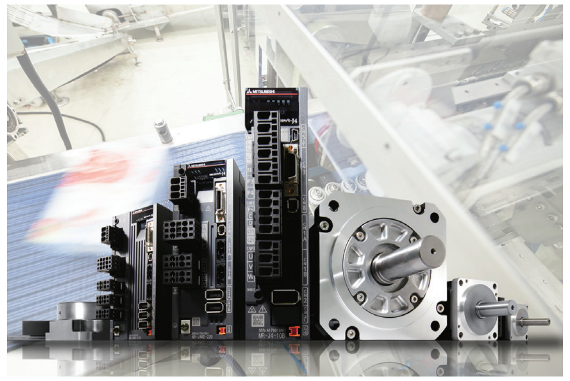
Enabling predictive operating environments
Machine innovation is being driven foremost by digitization and network standardization across the factory floor. The convergence of ethernet based IT networks with contemporary ethernet deployment within automation platforms has resulted in common securitization techniques, complemented by control vendor enhancements, and common protocols that permit vast amounts of production data to be analyzed and acted upon in real time. Common data requirements and virtual representations of factory operations and machine characteristics has resulted in a digitalization operation.

A major benefit of digitalization is the ability to analyze and optimize machine performance in real time, using data generated by embedded sensors fed into industry clouds. Leveraging this production data can lead to significant performance and cost improvements: Real time monitoring of the latest networked packaging machines for example, minimizes energy and material waste. It also avoids unplanned downtime as OEMs and third parties can provide targeted offers for auxiliaries, spare parts, and maintenance services.

The enhanced transparency of manufacturing systems and their operations enable customers to see potential improvements and act immediately. A beverage maker might now require that their bottling machine be designed to continuously optimize its own operation and be adaptable for instantaneous changes, such as handling multiple bottle designs. This electromechanical flexibility is driven by the ability to process orders in real time through extremely efficient supply chain operations linked directly to the retailers' demand management systems.

Mitsubishi Electric servos have the unique ability to auto-tune and auto-compensate for vibration anomalies while providing alarms that maintenance is required

Critical to these operations functioning optimally is the ability of machinery to forewarn and forecast appropriate maintenance issues. Rather than scheduling proactive maintenance, which can result in unnecessary downtime and costs, predictivity allows the machine to announce its status, behaviors and compensations for tolerance shifts or various performance anomalies. The value of analytics -diagnostics readily available, long term runtime monitoring for behavior patterns and deviations, analysis of root cause or likely cause sent to analytic compute functions at edge devices, is critical to optimizing production runs and machine availability.



Predictive maintenance requires that machine controllers monitor machine, production and operator behaviors against standards such that out of tolerance events or ongoing behaviors are alarmed and within reason, the machine allowed to operate until maintenance can be achieved while maintaining production.

Mitsubishi Electric servo systems have failure prediction modes and include sophisticated algorithms to compensate and alarm for specific impending failure modes such as;

- Friction failure prediction based on changes in the coulomb and viscous friction of guides and ball screws.
- Vibration failure prediction based on aging in guides, ball screws, and belts from the vibration and frequency changes.
- Total distance failure prediction based on the total travel distance of the servo motor to determine when ball screws and bearings are approaching product life.

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

Advancing robotic maintenance with AI
Mitsubishi Electric is using predictive maintenance possibilities for robots that can reduce operational costs, increase asset productivity and improve process efficiency.

The cloud-based solution is based on the AI platform within IBM Watson, which enables the smart analysis of operational data to highlight maintenance requirements.

The platform uses predictive maintenance models, digital simulation and extrapolation of trends to provide maintenance information based on actual usage and wear characteristics. This is particularly pertinent to robots, where users don't always appreciate that periodic maintenance is required.

Communications between the robot and the user via the cloud are two-way providing the basis for voice control of the robot. Maintenance activities are optimized through the use of smart glasses, where the operator receives guidance on what tasks need to be performed.The glasses can show CAD drawings of the various robot parts, superimposed over the robot itself. The glasses can also show the maintenance manual and individual instructions.