EFCO
EverFine Group

Smart System Maintenance: Artificial Intelligence in the System Integrator Toolbox

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Predictive algorithms improve reliability of industrial image processing systems

Maintaining deployed systems is a diverse and costly challenge for OEMs and system integrators. Costs and complexities can create serious and unexpected impact on performance, overall reliability, and of course the reputation of the system provider. As artificial intelligence (AI) is proving useful in a spectrum of other arenas, technology leaders are keen to access its value in distinguishing a much higher level of long-term, predictive maintenance strategies. This is particularly critical as industrial image processing becomes indispensable for Industry 4.0 and IoT applications – applications such as factory automation and machine vision benefit dramatically from detecting problems in advance and triggering predictive maintenance.

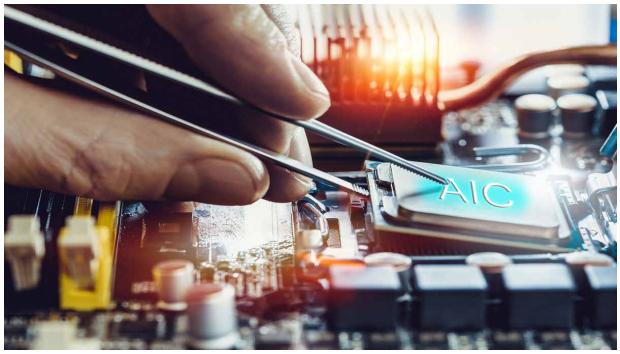
This is a leap forward as contrasted to using the system BIOS to set parameters for performance, without the advantage of predictive intelligence. But what does this mean exactly and how is it best executed? For the greatest value post product launch and deployment, early planning is crucial – this includes integration of AI-based monitoring capabilities as part of the application development process itself.

Bypassing existing limitations of maintenance and monitoring

Relying on the BIOS to set performance parameters has historically been the path used by system integrators. Data are gathered and tracked but, because this approach includes no predictive capabilities, performance failures are revealed only after they occur. Without the opportunity to prevent downtime in smart ways, the integrator's service reputation is entirely reliant on how fast they can respond to a failure. Yet in the age of the IoT, reliability and preventive maintenance for zero down time is the goal, increasing the focus on being proactive and preventing failures from occurring in the first place.

This is where AI steps in to add predictive value. By tapping into a software 'kit' during the application development phase, application designers can access a readymade set of AI capabilities, in turn, customizable to the application at hand. Developers are empowered to set performance parameters of various components according to application needs.

Coupled as an integrated component to an embedded box PC, optimized kits include their own separate processors, display modules and software that both monitors and analyzes critical system elements. Status is displayed either via the system's integrated display or user interface, and can include information such as CPU temperature, power consumption, RTC battery voltage, DC voltage, hardware health, and PoE status, as well as customized customer information. The added value of integrating AI capabilities in the earliest stages of application development are immense. Application engineers can see in real-time the effects their design changes have on the unit – this in turn, accelerates development time and ensures performance is native to application design.



EFCO's eKit provides an example of embedded artificial intelligence (AI) in action. Based on proprietary AI algorithms, this software-based program collects data from the device and performs dynamic, real-time monitoring of system behavior. The software is integrated into EFCO's Eagle Eyes family of embedded box PCs, operating on its own internal ARM board to monitor components ranging from hard drives to CPU. eKit allows customers to control functions normally only accessible through the BIOS and works on both Windows and Linux platforms.

Flexibility ensures smartest maintenance strategies

Application designers win with the combination of an internal processor architecture handling the real-time monitoring, along with an API library that enables self-development and avoids reinventing the wheel with every design. Instead of building predictive algorithms from the ground up, they can integrate a pre-built option into their own development process, connect to APIs as necessary, and easily program calls for service, tracking, and monitoring as they develop their own software.

AI capabilities can easily be customized by the end user to monitor functions important to preventing downtime. The software distributes alerts when parameters set by the user are exceeded, providing advance warning of poor performance or an impending component failure. Even as data is collected continuously, monitoring or reporting can be daily, weekly, monthly, or whatever interval is ideal for the application or particular system component. For example, a power supply may be monitored and reported in real-time, while fan reboots are reported less frequently. Because system data is continuously analyzed, the software also provides smart recommendations for proactive or preventive maintenance when certain thresholds are reached. For applications using PoE ports, the same AI software allows the reset of the individual PoE ports through the user interface or API, with no need to physically reset the peripherals.

Visual Inspection Image - the rear picture of the Eagle Eyes-AIH for the visual inspection (shows PoE ports):
PoE ports enable flexible quality control in industrial settings, for example powering cameras to transmit either still images or video capture of production lines. The EFCO's Eagle Eyes-AIH with ekit is optimized for the broadest variety of industrial inspection settings, with flexible input/output for easy integration and programming.

AI in action

The value of AI as a predictive monitoring tool can best be demonstrated in a series of performance-critical scenarios. Each of these vignettes describes a complex industrial application, where downtime not only impacts productivity and revenue, but can also jeopardize safety.

Public safety

A siren system mounted on police, fire, or other emergency vehicles requires a wide range of operating temperatures from -20 to ~70-degree C. These systems include a GPS module for tracking and a 4G SIM card to transfer field data to servers. For example, an audio capture device may be connected to the system via USB port. This is critical in certain geographic regions such as China, where laws prohibit long bursts of noise from sirens or horns. When a siren noise is louder than standard, the system detects an anomaly; video of the offending vehicle is sent to the cloud and a ticket is sent directly to the owner of the vehicle. The system's integrated AI capabilities also simultaneously monitor USB posts, GPS, and SIM card, alerting system operators if failure occurs with any of these components.

Chain retail

A supermarket's RAID system server may support an 8x3.5" HDD, used as a RAID system to back up and monitor big data such as transactions, inventory, and data related to customer traffic. This application might involve multiple user locations, each of which may contain its own RAID server that is then connected to a central hub. An optimal deployment uses AI at the hub level, monitoring all hard drives for uptime and preventive maintenance.

RAID technology ensures safe back up and monitoring of big data, common in retail chain settings with multiple locations and data sources. The EFCO's Eagle Eye-AIHL-ES (an ODM project) with ekit uniquely features artificial intelligence (AI) capabilities, protecting uptime and streamlining maintenance strategies and resources.

Visual inspection

Visual inspection systems are used in a variety of diverse production settings such as electronics goods or food and beverage packaging. In these kinds of scenarios, systems often incorporate 4x GbE PoE ports for cameras to inspect product quality with still image or video capture, as well as COM and Ethernet ports for motion control. A range of DI/DO options handle circuit or limit switching, pressure valves, light controls, and more. In these applications, AI is programmed to monitor PoE cameras and all DIO options to ensure maximum uptime; cameras automatically reboot in the event of a failure if initial troubleshooting efforts are unsuccessful.

Industry 4.0

Industrial robots are some of the most visual examples of automation at work. Increasing factory productivity, improving safety, and executing repetitive tasks perfectly and non-stop, this automated machinery allows its human counterparts to focus on the more complex management tasks involved in fabrication or manufacturing settings. In our example, isolated 8xDI and 8xDO allows them to detect movement, light, shapes, objects, and more. A DC-powered motor is connected via both USB and COM ports. AI not only monitors consistent connection of DIO, but also tracks motor performance to account for power fluctuations.

These complex systems handle repetitive tasks perfectly, detecting movement, light, shapes to work non-stop and free skilled personnel for higher-level tasks. The EFCO's Eagle Eyes-AIM with ekit adds further value with its monitoring of power fluctuations to ensure reliable, non-stop performance.

Precision automation

A laser welding machine is another example of an Industry 4.0 piece of equipment, although it may execute finely detailed actions as its primary task. Its PCI motion control card ensures high accuracy in a compact design, and it too has a DC-powered motor connected via USB and COM ports. This precision system is controlled by a touch panel, with a skilled operator managing its operations in real time. Its AI capabilities specifically monitor overall system temperature, with a mandate to predict and prevent overheating.

Embedding AI for competitive value

Even as specialized image processing machines are task-optimized to help ensure reliability, adding AI pushes reliability upward. With dynamic and real-time monitoring of system behavior, system operators can be both proactive and streamlined with system maintenance. Operations are stable at all times and users have advanced warning if proactive troubleshooting is required. Remote reset options are convenient and cost-effective – preserving productivity, resources, and revenue.

Industrial image processing is raising the bar for Industry 4.0 and IoT applications, appearing in more environments and safety-critical settings. With integrated AI, systems are just smarter – adding increased reliability and convenience as a competitive standard for design.

Our Services

Flexible and Collaborative Manufacturing Services

With more than 26 years experience, EFCO offers turnkey manufacturing services with state-of-the-art production equipment for both PCB assembly and complete system builds. EFCO utilizes its professional manufacturing process with customized designs in support of small/medium/large-volume and high-mix orders to achieve quick production ramp up and competitive ROI benefits. EFCO's in-house production center provides not only box-build services, but also Conformal Coating, Extended Temperature Screening, and Burn-In services, to ensure the best quality and product longevity.

International Quality Assurance Standards

EFCO is ISO 13485 and ISO 9001 certified, and its total quality management covers customer satisfaction, supplier management, product design and verification, manufacturing, and quality assurance. EFCO proudly offers our customers innovative products and services with the highest level of quality.

EverFine Group (EFCO)

Headquarters

10F-3, No. 270, Sec. 4, Chung Hsiao E. Rd.,
Taipei, 10694, Taiwan
Tel: +886-2-2751-7192
info@efcotec.com

Americas

2675 East Patrick Lane Suite #7, Las Vegas,
NV 89120, USA
Tel: +1-702-848-5320
sales-us@efcotec.com

EMEA

Ulrichsberger Str. 17 Haus G1, 94469
Deggendorf, Germany
Tel: +49-991-2009298-0
sales@efcotec.de

UK & Ireland

Tel: +44-0-7976-155552
sales-uk@efcotec.com