Leaner Maintenance Management with Control Systems Integrated CMMS

A white paper by Edward Garibian, eRPortal Software Group

Abstract

Managers of maintenance systems continually strive for leaner, more optimized work flows for providing asset repair and maintenance services. Gaining access to as much information as possible is key to achieving success in this endeavor. But in many cases, the maintenance management systems at manufacturing and industrial plants operate in isolation from other systems that contain valuable information. These include Plant Control and HMI (Human Machine Interface) systems, which contain information directly related to the state or condition of an asset. Integration with these control systems and properly sharing the information they contain helps maintenance personnel determine more effective ways to manage assets. The additional information can help maintenance staffs become more proactive and significantly reduce unplanned downtime. In addition to benefitting the maintenance management system, interoperability also benefits HMI systems and their associated work flows. By having information on the maintenance and repair status of assets, managers of each of these systems can also operate their departments more efficiently since they have the ability to make more informed decisions. This paper reviews the challenges of maintenance managers and the critical roles they play in an organization looking to optimize operations efficiencies. It also discusses the benefits of interoperating between CMMS and Control systems, including both SCADA (Supervisory Control and Data Acquisition) and DCS (Distributed Control System). The paper then presents potential options on how to accomplish varying levels of integration, including a low-cost computerized-maintenance-management-system (CMMS) that seamlessly inter-connects with HMI systems.

The Pressure to Create Leaner Maintenance Management Systems

Maintenance managers constantly feel pressure to create leaner systems. They must keep service costs to a minimum while ensuring assets perform optimally and function for as long as possible.

With an effective maintenance management solution, addressing these challenges is possible. Resources can be managed and assets can be tracked so that repairs and preventative maintenance are completed on-time to keep assets functioning properly. But isolated maintenance management solutions prevent industrial and utility plants from achieving optimal asset performance. The isolation makes it difficult to bring resource- utilization rates close to 100 percent and maximize production output as well as the overall lifecycle of each asset.

One of the keys to achieving a leaner system with the highest level of efficiency is to create an environment where maintenance management software interoperates with HMI systems. And in return, the maintenance system can provide valuable information to production or manufacturing personnel utilizing the inter- connected HMI.

Stakeholders Demand High Asset Performance at the Lowest Possible Cost

The need to integrate maintenance management with HMI systems is driven by today's business and political environments, where businesses and governments come under close scrutiny by business partners, customers, tax payers, and other stakeholders. Those charged with maintaining infrastructure, facilities, and valuable capital equipment must provide effective, timely, and reliable services—all while doing so at an efficient level of operation to help manufacturing firms and municipalities maintain lean budgets and justify strategic capital investments.

All organizations also need to ensure that every asset generates maximum output. This includes maintaining assets that operate close to 100 percent utilization or overall equipment effectiveness (OEE) levels as well as keeping assets in optimal condition so they produce for time periods as long as possible. Machines and other assets that break-down frequently or need replacements sooner than expected hamper the output capacity of any business or organization and negatively impact the bottom line.

HMI Interoperability Helps Maintenance Operations Gain New Efficiencies

Maximizing an organization's return on asset investment is paramount to operational success, regardless of industry. So, the utilization optimization of enterprise assets becomes a key focus. And, for enterprises of any industry, the ability to integrate and share information between software systems provides substantial benefits and increased productivity organization wide. Maintenance management integrated with Human Machine Interface (HMI) systems provides automated and streamlined solutions for higher levels of efficiency in handling an organization's assets. This capability holds true for machines with SCADA interfaces as well as mission-critical plants and lines that rely on DCS systems.

Maintenance management software that seamlessly integrates with HMI systems provides a platform for implementing usage-based preventive maintenance schedules instead of, or in conjunction with traditional calendar based PM approaches. Events such as run-time hours, starts and stops, and cycle counts can be used to create PM schedules.

Integrating with SCADA and DCS also helps the maintenance management process by automatically triggering maintenance work orders and requests based on machine condition. Maintenance becomes more predictive by giving maintenance managers the ability to configure rules for creating very detailed work orders that are triggered automatically. The rules can be based on any set of machine conditions and parameters that fall out of spec or reach particular levels. And integration with HMI systems also makes it easier to monitor and place JIT orders for spare parts in conjunction with the predictive/condition-based maintenance process.

An example is where an HMI senses a critical parameter of an industrial machine - such as pressure, vibration or current level – drifting continually out-of-spec. By Integrating the HMI and CMMS, and using a CbM approach, a specific work order, based on the actual out-of- spec condition(s), can be triggered and appropriate personnel notified. And the work order will list exact tools and procedures to address the issue based on the condition that triggered the event. This type of process not only dramatically reduces errors, but is a substantially lower cost maintenance (and operations) event than one where the asset is damaged greatly and operations are halted for a much longer period of time.

For processes that require the monitoring of liquids, gases, or other materials that are part of optimal asset operations, integration with HMI systems enables the CMMS to create purchase orders or requests for these materials if volume or quantity threshold levels are reached.

HMI system operators also benefit by having their SCADA and DCS interfaces integrated with maintenance management. With integration in place, operators gain visibility into planned maintenance activities so they know when machine production will be interrupted. They also gain access to machine operating manuals to help them participate in Total Productive Maintenance initiatives whereby they can fulfill the roles of conducting real-time inspections and preliminary maintenance. Operators of HMI systems can also submit work order requests more easily in real time when machine breakdowns or degradations occur. Integration with the maintenance management system also gives operators the ability to view records beyond past work history when trying to troubleshoot finicky machines. All of these capabilities can be managed without leaving the native HMI application.

And finally, another benefit achieved by deploying Maintenance management applications that integrate with HMI solutions is synchronization with the plant-floor operating model, including the automatic creation of assets and their associated hierarchies each time a new piece of equipment is created and deployed in the factory automation system.

Options for Integrating Maintenance Management with HMI Systems

Operator Mobility –

One way to achieve data exchange between the SCADA system and an organization's CMMS is to schedule periodic inspection rounds where employees with mobile devices collect data on key asset condition parameters. Parameters such as run-time or other equipment utilization levels can be recorded and then electronically input into the CMMS for PM or Condition based work order Trigger. This is an especially effective solution if the scheduling of these rounds already exists and asset condition or usage level recording is simply a matter of adding additional steps to an existing work order or inspection.

One initial point of consideration with this approach is the mobile strategy itself. Is the enterprise wide environment such that secure, real-time mobile connectivity can be readily put in place or already exists? If not, then off-line, mobile applications can be used to collect the data. Ideally, these off-line mobile modules already exist and are seamlessly integrated into your CMMS platform. If not, then the organization's IT or vendor supported tasks must include the ability to ensure an accurate and seamless method of collecting and then exporting data from the handheld devices to the CMMS.

In addition, the ability for the CMMS to import, record, and then react intelligently to the data must also be reviewed. Given the non- real-time nature of inspection rounds based data collection, this means the CMMS needs to have the ability to create PM schedules based on data imported that represents utilization levels such as runtime hours or other meter values.

Database Connectivity -

Another methodology that can provide interoperability between SCADA and Control systems platforms and the CMMS is creating a link between the CMMS and the Control system Tag Historian database. This is done by interfacing to the Historian db directly or via an ODBC interface, and then viewing or periodically polling specific tag values being tracked. Then, as specific tag levels or values are reached, as measured by the PLCs within the Controls/SCADA system, the CMMS rules then trigger work orders or inspections in response.

The benefit of such as approach is that the frequency and therefore accuracy of the information being published to the CMMS rules engine is much higher than that of mobile or inspection round centric data collection. This may not be a significant factor in the case of many utilization based triggers (ie, run time hours), but if the enterprise is looking to also add a condition based maintenance (CbM) work orders component to their asset management strategy, then a near real-time (set by polling frequency) level of information collection and measurement becomes highly advantageous.

Areas to consider with this approach include understanding the architecture of the Historian database and its ability to expose data values. This may mean the addition of a gateway module provided by the controls vendor, or the option of creating an export of the historized tag values to another database (ie, a warehouse) and linking that intermediary database to the CMMS. Either way, both costs and expertise regarding how the Historian database and the relevant data values will be properly exposed, must be considered. And this includes incorporating effective security practices, ensuring that in no way data values can be artificially fed back to the Controls platform.

Middleware Applications -

Another approach to consider when choosing to add value to the enterprise asset management system by integrating to the Controls or SCADA platform is to use 3rd party applications that utilize protocols such as OPC (OLE for Process Control). A huge benefit of this approach is that the burden of ensuring successful and effective interoperability now resides with the chosen middleware vendor and not on internal resources or sophisticated external IT resources.

Another nice benefit of this approach is that using a communications protocol such as OPC, produces a real-time read of any tag value that is being monitored, vs that of a polling interval by connecting to historian tags via ODBC. This is especially important when true Condition based Maintenance Management (CbM) is the goal.

As with any other integration approach, cost and ROI must be considered and any risks to Controls/SCADA security must be mitigated.

Maintenance Management Software That Facilitates HMI Interperability

A fourth approach to consider when deciding on a strategy to integrate HMI/SCADA and Controls systems with the Enterprise CMMS, is a Maintenance Management software solution, such as eRPortal. eRPortal Software offers a CMMS suite that seamlessly integrates with any industry standard HMI or Controls System.

The benefits of such as system include the real-time connectivity to the SCADA or DCS tags via OPC or native protocols (e.g., ArchestrA or FactoryTalk). This provides a platform for not only triggering PM work orders based on Asset Utilization values exhibited by an appropriate tag, but also one that gives the enterprise a rules based CbM foundation – triggering work orders for individual or combinations of tag values that reach specific levels, exceed thresholds, or fall below specification. Then, upon trigger, a work order with appropriate instructions or procedures, including properly specified parts and equipment, can be emailed, faxed, or electronically transmitted.

Operators can also view a maintenance activity dashboard, directly from within the HMI. Functionality can also include access to critical manuals, diagrams, or manufacturer specifications that are linked or attached to the asset or equipment master within the CMMS.

As with other approaches, proper thought and actions regarding security and system requirements must be considered and factored into any decision making. One advantage of this approach, however, is that fewer technology vendors are engaged and dramatically less IT resources are required. This approach does assume however, that no viable existing CMMS/ Asset Management software is in place, or the organization has contemplated a major upgrade of their existing system.

It's All About Increasing Asset Up-Time

The integration of maintenance management with HMI systems is about increasing asset up time – either that of production equipment or facilities infrastructure. Connecting to these systems allows the asset-maintenance staff to gain access to valuable information it previously could not consider when planning maintenance activity. By having this new information, maintenance can then be managed more proactively so that assets perform to optimal levels for as long as possible.

The integration also allows senior management to have a more accurate picture of how much of an impact the conditions and the status of assets will have on production. This leads to improved forecasts that allow the company to act ahead of time to possible threats that might cause production or operations to diminish.

As reviewed in this paper, there are multiple approaches or methodologies that can be considered to achieve various levels of information sharing and integration between CMMS systems and HMI/ SCADA platforms. Each option must be reviewed from organizational policy perspectives on–

√ IT Resources

√ Security

√ Existing systems

√ Costs

It's a matter defining tangible benefits, while acknowledging existing realities, and then ultimately determining true ROI.

About the Author

Edward Garibian is founder and CEO of eRPortal Software Group, a leading asset and materials management software provider, founded in 2004. Prior to eRPortal, Mr. Garibian founded Applied Software Technologies, a New England area IT Solutions provider in 1989, and held product-marketing positions at Analog Devices and engineering positions at Texas Instruments and EMC(formerly Data General). He is a BSEE graduate of the University of Massachusetts, Amherst.

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