Larger volumes of operational data, increased transparency and reporting obligations, increased demand for Web-enabled and mobile solutions and the increased need for compatibility and integration. These are some of the shifts that are impacting user expectations of human-machine interfaces (HMI).

In this context, the ‘best-of-breed’ approach of cherry picking hardware and software limits the potential for raising enterprise-wide performance through a truly integrated solution.

If, on the other hand, industry-leading products come in an already integrated solution, then the productivity, system and cost benefits can be extremely attractive.
Background

This white paper was commissioned by Schneider Electric with the objective of considering the changing user expectations of human-machine-interfaces (HMIs) and the advantage of integrated HMI and SCADA in delivering greater enterprise-wide intelligence and improved productivity.

The white paper was written by analysts of the Industrial Automation Practice at Frost & Sullivan.

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About Schneider Electric

As a global specialist in energy management with operations in more than 100 countries, Schneider Electric offers integrated solutions across multiple market segments, with leadership positions in public utilities and infrastructure, industry and OEMs, non-residential buildings, data centres and networks, and residential applications. Focused on making energy safe, reliable, efficient and clean, the Company’s more than 110,000 employees achieved sales of €19.6 billion in 2010 through an active commitment to helping individuals and organisations “Make the most of their energy”™.

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Operating and Monitoring Solutions

Beginning with the end in mind

The Monitoring Function in an Operational Context

Human machine interfaces (HMIs)\(^1\) play a critical role in enabling plant operators to monitor and perform critical control actions in an operational context as well as facilitating advanced visualization into supervisory and enterprise-level solutions.

The shortage of skilled operators, coupled with the need for higher efficiencies in manufacturing enterprises, is driving demand for easy-to-use, intuitive and intelligent devices with advanced visual functionality. This is where HMIs are making a difference.

Research by Frost & Sullivan suggests that the global market for HMI solutions (hardware and software) is forecast to grow from over 190 million units (or a total of US$2.25 billion in revenues) in 2010, to over 260 million units (with revenues of US$3.26 billion) in 2016\(^2\).

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\(^1\) Comprising hardware (such as touchscreen panels and mobile interfaces) and software, HMI solutions are used to monitor or log process data, annunciate alarms and improve operator productivity by enabling effective visualization of plant operations and efficient control.

\(^2\) World Human Machine Interface Market, Frost & Sullivan, 2010
HMI solutions are expected to play a more critical role in both process industry applications (such as food and beverage, pharmaceuticals and utilities) and discrete manufacturing applications (such as general manufacturing, automotive, metals manufacturing, packaging, aerospace and defence, electronics and semiconductors and machine tools).

As this market grows, user expectations of HMI solutions are changing as well.

**Operating and Monitoring: Current and Future Expectations**

Some of the key shifts impacting the operating and monitoring functions in the industrial space are the following:

**Large volumes of data:** In most operational environments, there is a marked trend toward larger volumes of data to be made visible and managed. In response to this need, the automation solutions industry has begun to deliver SCADA\(^3\) systems with increased sophistication, functionality and coverage. This means that they can now be leveraged across a larger number of industries and assets. Aiding this process are the more intelligent field devices that can now deliver richer and more meaningful information on processes they monitor.

In addition, the monitoring solutions have also evolved considerably. HMI software, for example, has evolved from being basic, single-node, single-machine/process applications with low quality graphics, to multi-node, multi-machine/process applications with intuitive graphical interfaces, and further, to integrated suites of software for complex manufacturing

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\(^{3}\) Supervisory control and data acquisition systems
and process industries. While commodity-type HMIs are still available, end users are now looking beyond basic HMI functionality. They prefer more intelligence in the panels, as information is processed to the enterprise applications in the offices beyond the shop floor. This increases the need for integration between the operation (e.g. SCADA) and monitoring (HMI) functions.

**Increased transparency and reporting obligations:** Regulatory requirements for richer, more transparent operational data increases the mandate for compliance and traceability (e.g. FDA 21CFR in the food industry or environmental regulations relating to fugitive emissions, waste discharge and energy consumption). In addition, the trend toward tighter integration of SCADA with business processes creates increased demands for the delivery of operational insight to enterprise level systems.

**Increased demand for Web-enabled and mobile solutions:** Manufacturing enterprises are faced with the growing need to have instant and reliable monitoring data from different locations, both within a plant and from other sites. This trend drives demand for Web-enabled HMIs. In addition, the use of HMIs that can enable remote monitoring and maintenance of automation equipment has been on the rise because this can significantly reduce costs when compared to local maintenance interventions.

Combined with this trend is the increasing demand for mobile interfaces for allowing operator mobility and engaging experts in the enterprises' decision-making process. Illustrating this trend is the fact that the mobile operator interface segment, which accounted for 3 percent of the total European HMI market in 2009, is expected to account for 12.8 percent of the same market by 2016\(^4\).

**Increased demand for compatibility and integration:** End users are keen to leverage the benefits of integrated solutions from reputed vendors with a wide suite of products and services, so that compatibility issues are minimized. They are also looking for HMI compatibility with more than just SCADA and PLC\(^5\), to other systems such as fire safety controls, door access controls, CCTV systems etc. The latest trend is to incorporate video streams into HMI screens for improved diagnostics of process events.

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\(^4\) Strategic Analysis of European Human Machine Interface (HMI) Market, Frost & Sullivan, 2010

\(^5\) Programmable Logic Controllers
Incomplete Answers to Customer Needs

Unfortunately, the current and future expectations of users are not always being addressed with complete solutions. The fundamental problem has been that machine control and system control have traditionally been on two different platforms and have not operated well together. Niche HMI equipment or software vendors are unable to provide holistic offerings or integrated solutions. Available industry solutions are for the most part good stand-alone products which require significant time, effort and expertise to integrate effectively.

A more compelling proposition for users is to have integrated HMI and SCADA as part of the initially designed system rather than a put-together solution.

Schneider-Electric’s Operating and Monitoring Solution

Schneider-Electric offers one such proposition – collaboration between Vijeo Citect SCADA and the new HMI, Magelis BOX and Panel PC.

“Beginning with the end in mind”, such a solution offers the benefits of a complete solution, where design and industry-leading components are made to work together seamlessly.

This means that users have the advantage of goal-driven design, as opposed to bolt-on applications as an afterthought. With Schneider-Electric’s integrated SCADA and HMI, there does not have to be a trade-off between best-of-breed components and integration.

Shared display

Thanks to integration, there is no need for two full levels of SCADA in the system. Via the Webgate feature, the operator can remotely pull up the HMI screen onto the SCADA screen in real-time. This means that users do not have to redraw screens and so engineering time for design and commissioning is brought down. Being an integrated offering using the same logic across screens makes it easier to learn and
operate and less expensive to maintain. This leads to a lower total project cost and operating cost.

This also means that HMI functionality can, with the necessary safeguards, be extended to more facets of operations, giving more stakeholders access to HMI-delivered data and doing so in an easy and economical manner. Given that other business and communication systems have already gone down the web route, this improves the fit of web-based HMI with the rest of the organization.

Alarm synchronization

In the current scenario, with alarms from SCADA systems and HMI, the operator has to contend with the problem of coordinating and responding to alarm floods or nuisance alarms. If managed poorly, this could result in lower process throughput, damage to equipment or, in the worst-case, a safety related incident.

With Schneider Electric’s shared display and control between SCADA and local HMI, there is no need to recreate alarms into HMI applications. In fact, this convenience means that relevant additional alarms can be added if needed and alarm management / synchronization features can be incorporated through an internal alarm buffer.
SCADA at field level

Apart from the benefits of integrated HMI and SCADA, Schneider Electric also has its new Magelis BOX and Panel PC in **rugged terminals**; ideal for trouble-free operation in standard, maintenance-free or harsh environments (extreme temperature; from 0 to 50 degrees C, vibration, shock etc). Capable of running both HMI and/or SCADA according to the customer’s architecture, Magelis BOX and Panel PCs have fanless units without rotating media which ensure that the need for maintenance is virtually eliminated. This makes it well suited to the extreme operating environments of the mining, oil and gas and marine sectors, as well as the dust environs of some food & beverage operations (e.g. milling). This means that users do not have to fit in complex and expensive enclosures and can minimize their replacement needs. Given the globalization trend across all of these sectors, companies are increasingly keen to avoid having to redesign systems or undertake additional certification processes as they expand their geographical footprint. With all Magelis BOX and Panel PCs UL certified⁶ and with all panels IP65⁷, companies are assured of durability and reliability of HMI whatever the location.

Universal BOX PC (1.6 GHz) and Performance BOX PC (2.26 GHz) at 8GB RAM offers **high computing capacity and storage**. This means that complicated data structures and graphics are well supported by high performance computing and adequate memory.

And as HMI customers move away from proprietary operating systems, the fact that the new Magelis BOX and Panel PC is based on **Microsoft Operating systems**⁸ and **Internet Explorer browsers** will ensure improved connectivity to other PC devices and business systems, as well as ease of use.

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⁶ UL is the safety standard for industrial control equipment
⁷ Ingress Protection (IP) rating that describes the degree of protection provided by an enclosure of electrical equipment. IP 65 covers protection against dust and water.
⁸ The Magelis BOX & Panel PC, HMI and SCADA support Windows 7 64 bits, to get up to 8Gb RAM for better performance
Industry-leading products and service

By virtue of being a tested and integrated architecture, it also makes for a more secure system. By virtue of being supplied by automation specialists who also bring vertical-specific experience, it is also easier to customize interfaces and applications to vertical-specific needs. And technical and design support comes from an integrated solutions provider, rather than from a one-off equipment supplier or software vendor.

In terms of connectivity, Dual Ethernet ensures that there are separate automation and IT data flows and the risk of excess traffic from other business users does not impact automation data flows.

Conclusion

In the final analysis, it is the operators who are the main actors in human-machine interactions. It is therefore, crucial that display interfaces and control functions are designed to ensure that operations can be performed reliably and effectively in all circumstances.

That is why the effectiveness of a HMI solution is determined by factors such as ease of use and productivity improvement.

A system that shares the same logic and display across both local HMI and central SCADA delivers on both these promises. A system which builds in intelligence, rather than adding on features, gives users the benefit of smarter design. Such a collaborative ecosystem for operations and monitoring, if leveraged appropriately, can deliver significantly improved enterprise-wide performance.
Integrated HMI and SCADA Solution: Reliability and Cost Benefits

**Context**
- **Customer:** Large gold mine
- **Challenge:** HMI components for critical compressor applications (in some of the world’s deepest mines) were going out of support with vendors

**Schneider Electric’s solution**
- Single system with HMI for compressors integrated to central SCADA through Ethernet connectivity.
- Webgate used as a backup.

**Benefits**
- Improved system reliability
- Lower maintenance of compressors
- Energy savings through improved visibility of compressor operation

*Source: Schneider Electric*