Case Study - OMRON*'s Integrated Machine Controller

Equipment Manufacturer Changes Platform Architecture to Deliver a High-Performance Controller

Programmable logic controllers (PLCs) are used to perform automation for a diverse range of equipment including industrial machines, elevators and automatic doors. PLCs process input from a variety of sensors together with recipe data predefined by the user to generate outputs to relays and other actuators. By speeding up the throughput of the input-process-output sequence, PLCs can control machines on the factory floor at even higher speeds, resulting in increased manufacturing productivity.

In recent years, the number of machines that integrate both motion control and relay switches has increased. Motion control enables electric motors to perform position control in machinery, such as machine tools, robot control, semiconductor production equipment and injection molding machines. By increasing I/O (input/output) throughput, a PLC can control motors with greater precision, thereby enhancing processing quality.

Currently, the maximum I/O throughput of conventional PLCs is around one millisecond for simple I/O configurations. In more complex cases, such as simultaneously controlling the motion of multiple motors, conventional PLC architecture requires significant changes in order to handle more I/O with higher throughput – a few hundred microseconds or less.

Adopting Intel® Architecture to Resolve Problems in Previous Models

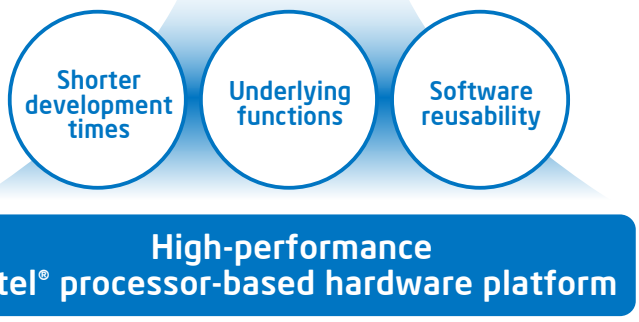
Previously, PLCs were designed with proprietary ASICs (application-specific integrated circuits) and general-purpose embedded processors used to control and monitor the system. The ASIC running the user program determined the core processing performance and functionality of the PLC. A drawback to this approach is custom ASICs are expensive to develop and manufacture, particularly with the higher costs associated with the latest semiconductor process technologies. The production of ASICs requires unique and costly photomasks, which are amortized over a relatively small PLC volume, making the cost per chip very high compared to ASICs used in mass-produced household appliances. Another issue is lead-time, since ASIC development can take as long as two years, followed by more time needed to test and qualify the operation of the ASIC as part of the PLC system.

In today's competitive environment, conventional ASIC-based architecture poses some major challenges in the areas of cost and development time. Despite these issues, industrial customers continue to demand controllers with higher performance and more sophisticated features. To satisfy the needs of customers, equipment manufacturers are under increased pressure to produce better products at a faster pace. Having recognized the limits of developing controllers based on ASICs, OMRON Corporation responded by switching its entire development process to an entirely new architecture that runs their control software on an Intel® processor-based hardware platform.

OMRON

Sensing tomorrow™

Integrated machine controller
NJ501-1500



Designing More Innovative Machine Controllers with Intel® Architecture Processors

Intel® Atom™ Processor Z530

The Intel® architecture product roadmap is industry-leading, thanks to a development model that successfully delivers next-generation silicon technology and new microprocessor architecture year after year. By pursuing this step-by-step strategy, Intel continues to develop microprocessors that demonstrate world-class processing performance, power efficiency and advanced technologies such as virtualization and remote management. With these features, controller developers can design more innovative products that address the growing requirements of industrial customers, today and tomorrow.

OMRON*'s new integrated machine controller is based on Intel architecture and supports all the the underlying PLC functions. This architectural approach allows OMRON to devote more resources to software development and focus on improving the performance of control applications. Using Intel processors eliminated the need for new ASIC development, thereby significantly shortening the product release period. This means OMRON can react promptly to new market and customer needs, as well as other factors that drive product changes. Moreover, the stability and dependability of the Intel® products roadmap enables OMRON to keep pace with medium to long term changes in customer behavior and more easily respond to a wide range of customer requests.

Since OMRON's new controller executes all of its software on an Intel processor, maintaining software compatibility for user programs is much easier, compared to ASIC-based controllers. This is because Intel processors have been running the Intel x86 instruction set in PCs and servers for several decades, and now in OMRON's new controller. This unprecedented track record is important since factory automation infrastructure typically runs the same control software for many years, and industrial users expect a high level of software consistency and reusability. Designing with software backward-compatible Intel architecture processors greatly improves the reusability of software assets and allows developers of integrated machine controllers to take advantage of leading-edge PC-based programming tools.

Intel's Platform Scalability Empowers High-Performance and Multifunctional Controllers

At the core of OMRON's integrated machine controller is the Intel® Atom™ processor Z530, which combines exceptional processing performance and outstanding power efficiency. The processor enables the controller to deliver greater I/O throughput than previous PLCs, thus it is well suited for automated production machine tools and multi-axis machines that require high speed and precision. For instance, with this remarkable performance, it is possible to combine motion control with conventional sequence controllers in order to control robots with other types of devices. For this type of controller, the Intel® Atom™ processor, with its minimal power consumption and low heat generation, is particularly ideal since there are normally strict thermal restrictions, such as fanless operation.

The Intel architecture enables the design of platforms with excellent scalability. A single architecture can be used for products that span a wide range of segments, from high-end applications that demand superior processing performance to low-end applications that value cost-performance. While OMRON's first integrated machine controller uses the Intel Atom processor, high-performance processors designed for PCs or servers are available for applications requiring additional processing performance. Recently, industrial applications have emerged that require controllers with the computing performance and advanced functions equivalent to a PC. Providing the option of selecting a microprocessor with even higher processing performance, the Intel architecture facilitates developers who are designing a family of advanced, high-performance next generation controllers.

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