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POWERING IoT AND EMBEDDED INNOVATION

How to Integrate Machine Vision into Industrial Systems

The confluence of AI and Industry 4.0 is transforming image processing. As machine vision becomes widespread, there is a growing need to transition imaging from a stand-alone process to a tightly integrated driver of industrial automation. Similarly, vision systems are increasingly expected to feed insights back into the business systems that monitor overall factory performance.

These emerging demands come with big challenges. Machine vision requires a tremendous amount of performance. Industrial IoT needs both secure connectivity and the ability to run business applications at the edge. And any automation system must adhere to the principles of long life, safety, and reliability.

Now operators want integrated solutions that minimize equipment footprint to save space, cost, and power consumption. In the past, this has left engineers guessing at how to fit these multiple demands into a single platform.

Developers must find new ways to integrate reliable, real-time control functionality alongside AI and IIoT capabilities. A multifunction industrial controller that can that accommodate many types of workloads with the minimum space, power consumption, and cost possible is often the best solution.

Let's take a look at the ways industrial machine vision controllers can meet the demands of real-time control, Industry 4.0, and computer vision AI functionality.

Next-Generation Imaging Gets Industrial-Grade

Consolidating diverse workloads onto the same controller requires advanced multicore processors with high-end graphics performance, flexible connectivity, and industrial-grade characteristics. Consider the 7th generation Intel® Core™ processors, which offer extended lifecycle support and bring multithreaded compute performance on two-to-four cores running at up to 4.20 GHz. For space-constrained and power-conscious systems, the devices are also available with a configurable thermal design point (TDP) as low as 35 W.

Even more important for machine vision applications are the processors' integrated graphics units, such as Intel® HD Graphics 630. Intel HD Graphics GPUs contain a number of general-purpose capabilities that offload deep learning inference and computer vision operations from the CPU cores as shown in **Figure 1.** The integrated GPUs also provide acceleration for high frame rate applications like industrial machine vision—paired with frameworks such as the Intel® OpenVINO™ toolkit to speed the execution of OpenCV and OpenVX vision functions.

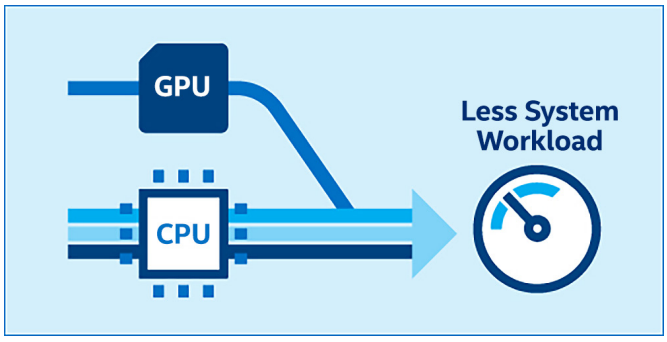

Figure 1. Intel® HD Graphics technology integrated with Intel® Core™ processors accelerates DL and CV workloads while offloading them from primary CPU cores. (Source: Intel® Corporation)

Compared to previous generations, the graphics performance of Intel Core devices can also produce and manage 4K video content much more effectively. This is due to technologies such as Intel® Quick Sync Video. Quick Sync helps increase frame processing, while also supporting fast encoding, decoding, and transcoding of codecs such as 10-bit HEVC, VP8, VP9, and VDENC.

The integrated graphics processors also natively support three independent displays. This capability is brought out through the Intel® Q170 companion chipset to Intel Core processors, which provides up to 20 PCI Express 3.0 lanes, up to 10 USB 3.0 ports, up to 14 USB 2.0 ports, and an integrated Ethernet MAC.

In addition to interfacing automation data across multiple HMIs, this enterprise-class connectivity can carry CV algorithms being refined in the cloud to machine vision systems on the edge. Not only does this allow these systems to improve throughout their deployment lifecycle, it also helps guard against obsolescence as CV technology advances.

Expanding Options for Industrial Workload Consolidation

The acceleration and offload capabilities of integrated Intel HD Graphics technology, alongside the Intel Q170 chipsets networking functionality, ensures that precious clock cycles are preserved on the Intel Core processor CPU cores. When paired with the right machine vision system architecture, these cycles can be used on safety-critical sensing and control tasks that enable engineers to maximize the functionality of a single controller.

The VCO-6000 series from Premio, Inc. is an example of highly integrated industrial machine vision controllers that support Intel Core i3, i5, and i7 processors **(Figure 2)**. The customizable, fanless systems can be configured with as many as five PCIe expansion slots, enabling the systems to accept a range of different data acquisition and I/O modules for motion control, video capture, or the use of protocols such as CANBUS or PROFINET. Three additional mini PCIe slots can even support high-speed wireless or cellular communications.

Figure 2. Premio, Inc. VCO-6000 Series of industrial machine vision controllers provides up to five PCIe expansion slots and three mini PCIe slots for extended system functionality. (Source: Premio, Inc.)

What really sets the VCO-6000 series apart for industrial automation applications like machine vision is the physical and electrical isolation of its 16 digital I/O pins (eight digital input, eight digital output). Because the family of controllers supports voltages ranging from 9 VDC to 50 VDC, the isolated I/O allows two parts of a circuit to be set at different voltage levels. This helps protect system circuitry from transient voltage spikes and improves common-mode voltage and noise rejection in environments with other machinery and inductive loads.

The 6000 series also includes safeguards such as over-voltage (OVP), over-current (OCP), and reverse protections to ensure the reliable operation of industrial sensors, motion control systems, and HMI devices. The systems support a -25° C to +70 °C operating temperature range, and are compatible with Microsoft* Windows 7, Windows 10, and Linux operating systems.

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Integrate Advanced Industrial Functionality Reliably and Economically

Although today's industrial systems are adding performance for advanced functions like machine vision and Industry 4.0 connectivity, they must still adhere to the principles of long life, safety, and reliability. At the same time, manufacturing and automation companies are looking to minimize the footprint of the systems the deploy to save space, cost, and power consumption. In the past, this has left engineers guessing at how to fit these multiple demands into a single platform.

The Intel Core processors and other corresponding Intel technologies offer a scalable foundation for meeting all of these requirements. And when implemented in highly integrated, expandable systems like the VCO-6000 series, the question becomes "What do we need?" instead of "How do we do it?"

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