

GigE Vision makes strides

Steve Scheiber, Contributing Technical Editor

High-speed vision standards offer numerous advantages, but the standards themselves represent only a means of communication. Success in implementing them depends on understanding the tasks they perform and the equipment that supports those tasks.

In November, Matrox Imaging introduced its first interface card that incorporates the new Gigabit Ethernet (GigE) Vision standard. Recognizing the considerable buzz surrounding the standard, product manager Dwayne Crawford declared that the launch “allows customers to take advantage of the latest technology in the most optimal fashion.”

I asked Crawford about the challenges that a manufacturer would encounter when implementing the standard for the first time. He noted that the industry is touting GigE Vision as the up-and-coming technology that will eventually dominate the market but that the critical issues have not changed.

“Regardless of the standard deployed in an application,” Crawford said, “machine-vision developers must choose their components carefully.” He added, “We expect most of the new GigE products to be released in the foreseeable future will be cameras.”

Network interface cards

Although cameras that conform to GigE Vision will connect to any standard network interface card (NIC), some NIC models work with high-bandwidth cameras better than others. Crawford recommended that users look for an interface card that supports jumbo frames, interrupt throttling (sometimes called moderation), and receive descriptors (see “Choosing a network interface card for GigE Vision,” on the next page). Furthermore, because GigE Vision is more complex than its conventional

Ethernet predecessor, you will have to configure the interface card for optimum performance.

Before developing a GigE Vision application, you should determine how many I/O lines you will need. As engineers in the IEEE 1394 (FireWire) community have already discovered, most typical NICs lack auxiliary I/O.

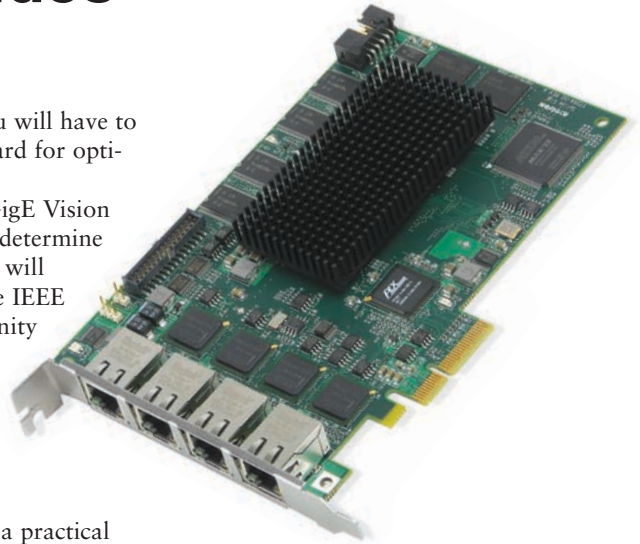
Although accessing system I/O on the camera itself rather than on the frame grabber offers a practical alternative and proves equally effective, the camera may not possess enough I/O lines for your application. More importantly, the camera’s decision-making capability is often limited. Crawford cited one example in which “a camera could not report to an application that a trigger had been missed because pulses were spaced too close together.”

When selecting components, you should also evaluate the application’s image-processing requirements. Standard NICs often cannot cope with CPU-intensive preprocessing tasks such as filtering, color-space conversions, and transformations. Instead, many users incorporate specialized frame grabbers into the process to execute these tasks.

Camera description file

The GigE Vision standard characterizes camera functionality according to the camera’s end use. Some processes require control of the image size, while others demand acquisition and trigger controls, digital I/O, and analog controls.

Within each of these categories, the GigE Vision standard flags each permitted feature as mandatory, recommended, or optional. Out of the approximately 180 standard features, only a handful are mandatory, although most are recommended.



Developers of GigE Vision systems should specify a network interface card that is designed for high-bandwidth applications. Courtesy of Matrox Imaging.

Aside from the technical specifications, what will distinguish one GigE Vision-compliant camera from another? How can you select one that suits your needs? Crawford summed it up succinctly, “Everything depends on the extent to which a particular camera implements the standard feature list.”

GigE Vision requires that all camera features be described in a “camera description file” that follows XML syntax. As long as a vendor describes a feature adequately through the XML file, the end user can exercise complete control over it. When an application or driver parses the camera’s XML file, it retrieves the machine-readable equivalent of the camera’s “instruction manual.”

The GigE Vision standard dictates that for a camera to be considered compliant, its XML file must support the appropriate mandatory features. Many cameras also exhibit a list of optional features. A truly compliant setup will implement the standard feature list in such a way that a camera from one vendor can

easily be replaced with one from another—a real plug-and-play solution.

For machine-vision developers to successfully implement GigE Vision, they must understand its benefits and limitations. They must also consider the extra costs associated with additional I/O lines and with alleviating the burden on an overloaded CPU.

Crawford summarized, “Developers should buy their cameras from a reputable vendor, and they should seek out a NIC vendor who understands and addresses the unique challenges of the machine-vision industry. But hardware and software go hand-in-hand. A software environment that implements the standard feature list and incorporates custom features as well will enjoy the greatest acceptance in this competitive marketplace.” □

FOR MORE INFORMATION

The GigE Vision standard is administered by the Automated Imaging Association. It was officially introduced in May 2006. www.machinevisiononline.org.

The GigE Vision specification relies on the GenICam standard to describe the features supported by a compliant camera. GenICam is a generic programming interface that is administered by the European Machine Vision Association and supports cameras for various buses. www.emva.org.

Choosing a network interface card for GigE Vision

When you are setting up a machine-vision system based on the GigE Vision standard, Matrox recommends that you look for a network interface card (NIC) that supports:

Jumbo frames—Jumbo frames are GigE data packets that hold more than the standard 1500 bytes. Setting the NIC's jumbo frame size to a large value improves GigE Vision's performance, because each packet can transfer more data, so the transfer process interrupts the CPU less often.

Interrupt throttling—The interrupt throttling feature allows the NIC to delay interrupting the host system until a specified number of events have occurred. The NIC then interrupts the CPU only once and transfers all queued events. This feature means that the host system does not have to service an interrupt for every packet received.

Receive descriptors—Receive descriptors are software metadata that the NIC associates with data packets that it buffers in memory. The more receive descriptors that an NIC has available, the more packets it can buffer. A large buffer space also ensures that all packets can be processed—that is, none will be overwritten before the host can deal with them.

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