

Gaining Performance and Cost Advantages in Military Vision Systems with Gigabit Ethernet

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Vision systems for military applications such as local situational awareness (LSA) and closed hatch driving (CHD) use advanced cameras, displays, and analysis software to identify surroundings and potential threats, improving surveillance and intelligence while keeping personnel out of harm's way. The video interface used to transfer data from the camera's image sensor to a display or analysis computer (PC) is only a small part of the vision system, but has a surprisingly large impact on its overall design, cost, performance, and lifespan.

Traditionally, military vision systems have used point-to-point interfaces to connect image sensors to displays or PCs. These umbilical connections, based on analog, Camera Link®, or low-voltage differential signaling (LVDS) standards, require a dedicated wire between each camera and its endpoint, whether that be a PC or display. In applications like LSA and CHD, where many cameras are involved, the cabling becomes costly, complex, heavy, and difficult to manage and scale.

To address this issue, designers of military vision systems are taking a serious look at advanced digital video networks based on Gigabit Ethernet (GigE) infrastructure. GigE is a natural choice for video transmission within military vehicles, allowing designers to fully support required umbilical point-to-point performance while gaining networking flexibility advantages, the ability to interwork with a range of different computing platforms, while employing lighter weight, off-the-shelf Cat 5/6 cabling.

Moreover, since the launch in 2006 of the GigE Vision® standard for video transfer and device control over GigE networks, a large number of products that comply with GigE Vision have been launched by video hardware and software vendors. These products – external frame grabbers, embedded video interfaces, cameras, video receivers, video servers, control applications, and management entities – interoperate

Advantages of GigE Interfaces in Military Vision Systems

NETWORKING	Efficient and seamless transport of video to mission computers, processing units, and displays.
HIGH THROUGHPUT	Enables high-bandwidth imaging data from multiple analog and digital cameras to be sent over a single GigE link.
SCALABILITY	Enables dynamic network additions and reconfiguration and easier system upgrade to accommodate increasing bandwidth requirements for new system elements.

Table 1: Advantages of GigE Interfaces in Military Vision Systems

seamlessly over the GigE platform.

Using these products, designers of military vision systems can integrate different types of cameras, displays, and processing computers into a single, real-time video network based on the GigE Vision standard, simplifying and cost-reducing the design of multi-screen applications like LSA and CHD.

GigE Vision interfaces transfer imaging data from a camera or image sensor over Cat 5/6 cabling directly to the Ethernet ports found in most computers, eliminating the need for the PCI frame grabber required by analog, Camera Link, and LVDS interfaces. Freed of the need for a PC with a peripheral card slot, designers can choose computing platforms with smaller form factors – such as embedded processors, single-board computers, laptops, and tablets – for control and analysis. This can lower component costs, minimize footprint, and reduce system complexity. In addition, the flexible, lighter, field-terminated Ethernet cables cost less and are simpler to install and maintain than the bulky cabling and connectors of legacy interfaces.

The switched network topology enabled by GigE Vision paves the way for significant reductions in wiring requirements. Using a straightforward Ethernet switch, imaging data can be multicast from one camera or image sensor to multiple displays, or images from multiple cameras can be combined on

one mission computer or processing unit. This reduces system complexity and makes it easier for vehicle occupants to decide “on the fly” which video streams they need to see, without any changes to cabling or software configurations. It's also much simpler to add a new camera, display, or computer to the system.

Military vision system designers can choose from a range of GigE Vision-compliant, commercial off-the-shelf (COTS) video interfaces. For in-vehicle retrofit programs, external frame grabbers can be used to convert feeds from existing analog, Camera Link, or LVDS cameras into GigE Vision-compliant video streams that are all-digital, all-networked, and manageable. This allows end customers to preserve capital investments in cameras, sensors and processing systems, while gaining the performance advantages of Ethernet. Many camera manufacturers also offer native GigE Vision cameras for military vision systems and, for specialty applications, GigE Vision-compliant embedded video interfaces can be integrated with custom sensors or optics.

Whether it's an in-vehicle system retrofit, or a new project based from the start on compliant products, GigE Vision-compliant equipment helps military vision system designers drive down costs, ensure interoperability, deliver scalability, reduce cabling weight, and improve flexibility. *