Ready for Prime Time

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Sending multiple analog video signals to a central office is not always an option. Local processing using a software-controllable video switch could solve the problem

Image Sensing Systems has been developing and marketing the Autoscope® product family for more than two decades, providing video solutions in more than 50 countries. To date, Autoscope systems have been supplied for more than 40,000 cameras worldwide for a broad range of applications, including tunnel incident detection, junction control, motorway transportation management and traveler information.

At the core of any successful electronics product line, is an efficient 'engine' that is easily replicated in various forms. In the case of the Autoscope video vehicle detection systems, this engine is the on-board machine vision processor (MVP) with built-in video digitizer, processing algorithms and real-time communications. The Autoscope MVP is unique in that it is environmentally hardened and it is engineered to provide the functionality required by diverse traffic monitoring, data collection and incident detection applications – all on one board.

Image Sensing Systems offers traffic video detection systems in two basic configurations: the Autoscope Solo Pro, an integrated sensor with camera and video image processor in one compact housing, for customers who prefer the integrated solution; and the Autoscope RackVision product family standalone image processors, for those who prefer a separate camera from the processor or who require processing systems for cameras already in place.

While the Autoscope Solo Pro with its integrated zoom lens and color camera provide as yet unmatched, market-leading performance with superior video quality, camera optics control, and color image processing, we will hereafter describe the evolution and breath of the equally successful Autoscope RackVision product line.

Card Game

Just as the on-board MVP is the engine for the Autoscope family of products, the RackVision card is the basic building block of the RackVision System product line. Since its introduction in 2003, over 3,000 cards have been shipped worldwide, signaling overwhelming customer acceptance.

Figure 1: Euro Card version of the Autoscope RackVision single-camera Machine Vision Processor

The Autoscope RackVision card is a single-camera, configurable processor with onboard detector outputs, non-volatile data storage and video output with detector graphics overlay. As previously discussed, this single card meets detection requirements for a wide variety of applications ranging from junction control, to incident detection on highways, bridges and in tunnels, and traffic data collection on roadways to name a few. Since all this functionality is available on the one environmentally hardened card, there is no need to purchase additional cards for added functionality, inventory for spares is kept to a minimum, and the system is easy to install and configure into a Euro rack environment.

This card is available in two formats to suit customer requirements in different markets. A Euro card version with onboard detector outputs accessed via its backplane and a North American version that is plug compatible with loop detector amplifiers with its I/O located on the front panel and the rear card edge.

Figure 2: Operational RackVision MVP integrated into the Swarco ITC-1 signal controller for junction control

The RackVision Euro card comes in a standard 3U x 160mm format as shown in Figure 1. It has been successfully integrated into several European signalized junction controllers, such as the Swarco ITC-1 controller, as shown in Figure 2. The Euro card has been used extensively throughout Europe for highway, tunnel safety and monitoring applications.

Figure 3 shows 21 RackVision processors operating in the Delnice Control Centre in Croatia, which monitors the Cardak, the Pod Vugles, and the Javorava Kosa tunnels where they are used to detect stopped vehicles, wrong direction vehicles, slow moving vehicles and smoke in order to alert the tunnel operations personnel. All video is routed to the Control Centre on fibre optic cable from these three tunnels to ensure good quality video for processing.

Figure 3: Autoscope RackVision Euro cards operating in Croatia

Figure 4: North American version of the Autoscope RackVision card

The North American version of the RackVision is shown in Figure 4. All inputs and outputs are located on the doublewide front panel and when plugged into traditional loop-detector racks, the detector outputs can be assigned to the card edge connector. This version can be shelf mounted in its own enclosure as well as plugged directly into loop detector racks or input card file racks. This model is available in North America and Latin America through our North American partner, Econolite Control Products, Inc.

These RackVision cards have been used worldwide to provide detector output to SCATS, SCOOT, NEMA, 170/179, 2070 and European signal controllers for vehicle presence and alarm outputs and to provide serial output for traffic data collection and alarm notification.

Turn key kit

To provide further convenience to simplify installation and system configuration, the Autoscope RackVision System RVS-16 is shown in Figure 5. Basically, the system comes with its own custom backplane and standard power supply to provide a plug and play video vehicle detection for between one and 16 cameras, with minimal setup and equipment configuration required.

The RackVision System can be custom ordered with just the number of processors needed for the application at hand. If more than 16 cameras are required, multiple chassis may be daisy-chained together so that a single communications channel can be used to collect traffic data and alarms from all video processors. Connection to this communications bus can be made via the backplane using RS-232 or RS-485 serial communication or using standard Ethernet 10/100mbs connection to support the ever increasing availability of Ethernet in field cabinets. Figure 6 shows fully configured RVS-16 units undergoing Factory Acceptance Testing prior to deployment in an urban highway monitoring project. All input/outputs to process 64 cameras are wired permanently in the back, leaving the front clear and accessible for maintenance purposes.

Figure 6: Fully configured RackVision System RVS-16 units to provide 64-camera highway monitoring capability

The RackVision System's Video Mux module provides a video switch capability so that the video of any one of up to 16 cameras can be routed to the video output. Additionally, each RackVision System has an auxiliary video input, so that the video output of one RVS-16 can be directed to the auxiliary input of the next. In this manner, any number of cascaded Autoscope video cameras, plus one CCTV surveillance camera, can be selectively sent over a single, home-run fiber optic cable for transmission to the TMC, providing substantial cost savings.

Finally, to ensure the widest range of applicability, the RackVision System offers the convenience of either mains power or external DC power to meet the needs of system integrators who seek to keep their system costs at a minimum.

Figure 7: The Autoscope RackVision System RVS- 4 configured for four-camera processing with the serial version of the Video Mux module and with optional Detector Rack Card

Four Into One

The RackVision System is also available in a custom-size chassis with slots for up to four RackVision cards. The RackVision System RVS-4, shown in Figure 7 uses the same Video Mux module and power supply as the RVS-16. In the event that more detector outputs per camera provided, there is a slot for an optional Detector Rack Card, which can provide up to 16 additional detector outputs, which can be used by any of the four on-board RackVision cards.

During the past year, a self-contained shelf-mount, single-camera processor called the RackVision System One, shown in Figure 8, was successfully test-marketed in Asia. It is currently being revised to add an Ethernet connection which will be available early in 2006. The RVS-1 rounds out the Autoscope RackVision family of products by providing a solution for single-camera installations where processing at the bottom of the camera pole is required.

Conclusions

Today, the Autoscope family of traffic video detection systems are used worldwide for traffic control, transportation management, information, and many other related traffic applications. In response to customer needs and requirements, Image Sensing Systems offers the Autoscope RackVision system family of products for applications where video from multiple cameras is brought to a single location or node for detection processing, such as a hub or traffic management center. This family Autoscope Solo Pro family of smart cameras that provide premiere performance for traffic management applications.

Figure 8: The Autoscope RackVision System One RVS-1 test product for single-camera traffic detection

The core engine of the RackVision System is the RackVision card processor itself. Since these cards are ruggedized machine vision processors, not industrial computers, they can be located in a street-side cabinet if needed thereby lowering the system cost. The RackVision machine vision processor, as with the Autoscope Solo Pro system, provides junction detection, tunnel wrong-way and stopped vehicle detection, and other traffic management and control functions all in one card, an approach that has been subsequently adopted by other suppliers.

While the RackVision card itself is easily installed into a Euro rack environment, the benefits of using a RackVision System include simple video switching, reliable Ethernet communications and considerable time savings during installation. The System is used in applications where video from traffic cameras is brought to a single node for detection processing such as tunnels, large junctions and motorways with local cabinets.

As transportation officials deploy more and more CCTV surveillance cameras and traffic detection cameras world-wide, they quickly discover that it is no longer an option to bring the analog video back to the central office from every camera. It is either too expensive or exceeds the existing fibre optic cable capacity. The RackVision System provides significant cost savings by offering the choice to process up to 16 cameras

locally. Furthermore, it has built-in video switch capability to select one channel of video for transmission to the central office if desired.

Finally, video detection systems are much safer and easier to install and configure than inductive loop detectors. The Autoscope family of machine vision processors have clearly demonstrated that video detection systems for traffic management are now ready for prime time.■