

Pre-Emptive, Economic Security for Perimeters & Outdoor Areas

Without reliable detection, an outdoor security system cannot be trusted.

Excessive false alarms waste manpower and fail to command appropriate attention. Learn what is essential for reliable outdoor security.

Executive Summary

For years, automated surveillance has held the promise of providing a foundation for reliable outdoor security. However, high false alarm rates due to weather, wind, vibrations and lighting have left many security managers and systems integrators frustrated by broad claims and unfulfilled expectations.

Consider the U.S. Dept. of Homeland Security's conclusions regarding automated surveillance for the border¹, which found that 99% of the alerts were – in reality – false alarms. With 99 out of 100 border patrol agents chasing phantom threats, it is hard to imagine any security officer willing to take such a system seriously.

Businesses and other organizations are similarly challenged. Most attempts at automation for outdoor security have had limited success. Fence sensors, Intelligent Video Surveillance (IVS), buried line sensors, Passive Infrared (PIR), radar, and other detection technologies all suffer from the same problem: Excessive false alarms.

Of the technologies, video has emerged as the most appealing for surveillance automation because it provides instant verification of an alert's exact cause. For example, an alerting object can be clearly indicated by highlighting the object in the video display, often by placing a box around the target. However, the challenge still remains to find a reliable automated video approach that can be trusted to generate legitimate alarms without generating excessive false alarms.

Placing significant processing power *inside the camera itself* is the solution that makes video detection both reliable and cost effective. Such processing resources make it possible to analyze the full visual detail of every video frame, eliminating – at the source – all the impediments that would otherwise trigger false alarms.

Such reliable, remote detection provides the ability to resolve threats at the furthest point from an organization's critical assets, providing true pre-emptive awareness around a security situation. This is the value of high-powered, *edge-based video surveillance*, and forms the foundation of enterprise-wide security that you can trust.

¹ Office of Inspector General, "A Review of Remote Surveillance Technology Along U.S. Land Borders," December 2005

Outdoor Solution Requirements

Most video surveillance products try to satisfy both indoor and outdoor applications, and tend to be much simpler shared or single processor-based architectures. This is because static indoor environments make few demands on processing power, and competitive pressures force inexpensive designs. Outdoor applications, on the other hand, must compensate for poor and constantly changing lighting, gusty winds, large coverage areas, and limited network connectivity. Trying to satisfy both environments in the same product will never meet outdoor requirements.

Instead, an optimal outdoor camera should be specifically built for outdoor conditions, and incorporate enough built-in video processing to compensate for lighting, wind and vegetation motion. An outdoor camera must also be packaged in an appropriate enclosure to manage temperature and moisture extremes.

By incorporating a multi-processor design at the network edge, a number of benefits accrue:

- Extended detection ranges with low nuisance alarm rates are achieved when the full visual detail of every video frame is analyzed. This can only be accomplished with sufficient processing power in the camera.
- Wind and vibration is best managed through robust sub-pixel image stabilization, achieved through tight integration between the electronic processing and the optical core.
- The effects of clouds and shadows, rain, snow, etc., and lighting variations are eliminated by processing and filtering the image before it is analyzed for policy violations.

This combination of processing performance and core functionality can firmly deliver on the promise that outdoor surveillance has sought to bring: Pre-emptive, economic security for perimeters and outdoor areas.

Reliable Intruder Location Awareness

A complete and reliable video surveillance architecture should not only provide the “what” of a security breach but needs to also incorporate the “where,” by plotting the precise target positions of security violations. While some products have been able to provide some elements of this functionality, it has historically been accomplished through an exhaustive and largely inaccurate calibration process that relies on interpretation and extrapolation.

A better approach is to geo-register the entire scene and all associated security policy zones, allowing for terrain undulations and varying camera installation heights, a capability made possible when enough processing is available in the camera itself. In this case, the detected target information can be used to position a Pan-Tilt-Zoom (PTZ) camera directly on the target for identification, as shown in Figure 1.



Figure 1: Intruder Location Map

The result would be instant and accurate information regarding both the “what” and “where” of any and all security breaches. This could also facilitate identifying and tracking targets that have exhibited suspicious behaviors (i.e. loitering, running, etc.) in zones established next to the secured areas. This capability can provide a pre-emptive posture to the security operation.

Complete geo-registration of targets and the sensors themselves can enable enterprise scalability, increasing both the effectiveness and efficiency of security manpower. Consider a Security Operations Center (SOC) for an electrical utility, with dozens of remote switch yards across multiple locations. Reliable, geo-registered targeting can provide the location of the switch yard under threat and the exact position of the threat relative to critical areas within the infrastructure. As a result, security teams can be dispatched for quick response to the exact location.

Building a Pre-Emptive Security Operation at the Lowest Cost

The ability to successfully manage outdoor security through automation can provide the security professional a new level of rigor and effectiveness. But the question might still be asked, “Can this be affordable”. Experience shows that the amount of manpower resources required to do a similar job would be cost prohibitive, and even then vigilance is not guaranteed. However, when the right mix of technology and personnel come together the economic equation can also make sense.

Real-World Case Study: Edge-based Surveillance in Action

Figure 2 shows a real-world example of how ten edge-based, multi-processor cameras can be used to secure a petroleum refinery perimeter, instead of the thirty single-processor cameras that would otherwise be required. The topology map has been overlaid with a perimeter security design using the SightLogix™ SightSurvey™ design tool. Each icon represents a single camera with its corresponding field of view (blue cone). In this particular case, the frontage behind the administration buildings did not require coverage.



Figure 2: Refinery Perimeter

The remaining total perimeter spans approximately 3.4 miles. Ten multi-processor, edge-based sensors adequately cover the entire perimeter. Each location will require a mounting pole, power, and network connectivity.

This same perimeter using single-processor camera alternatives would require at least three times as many camera locations to adequately detect intrusions, and would also be plagued by unacceptable high False Alarm Rate / Nuisance Alarm Rate (FAR/NAR) levels.

The location and distances covered by each multi-processor camera are detailed and listed by the SightLogix™ SightSurvey™ design tool, and are identified in Figure 3 below.

#	Cam ID	Type	Name	FOV	Location	Height(m)	Tilt Angle(°)	Pan Angle (°)	Far End Dist(m)	Close End Dist(m)
1	2	Wired Visible Cam		22	29.951095,-93.887626	7	-9	-44.2	288.3	22.5
2	3	Wired Visible Cam		8	29.949413,-93.88562	7	-3	49.5	754.6	66.6
3	4	Wired Visible Cam		6	29.954451,-93.880835	7	-2	95.8	1022.4	94.1
4	5	Wired Visible Cam		7	29.962538,-93.882036	7	-2.5	127.4	815.5	86.5
5	6	Wired Visible Cam		9	29.968096,-93.887154	7	-3.5	-179.6	714.9	62.6
6	7	Wired Visible Cam		18	29.967836,-93.894031	7	-7	-139.6	344.1	28.6
7	8	Wired Visible Cam		13	29.966014,-93.89652	7	-5	-171.5	464.5	40.2
8	9	Wired Visible Cam		8	29.965308,-93.901209	7	-3	-39.6	797.4	66.6
9	10	Wired Visible Cam		15	29.960856,-93.894761	7	-6	-127.2	426.9	34
10	11	Wired Visible Cam		22	29.957956,-93.897448	7	-9	-42	285	22.5

Figure 3: SightSurvey Analysis

The result is a vastly lower project design, installation, and maintenance cost with dramatic increases in performance, range, and reliability.

Focused Spending Lowers Total Cost of Ownership

The value of a video surveillance system cannot be determined by simply comparing the cost of the software/channel or the cost of a camera. The overall solution cost includes a significant amount of infrastructure. In fact, infrastructure costs can be the most expensive portion of a deployment. Extending the effective sensor detection range through powerful edge-based processing directly translates into a reduction in the number of cameras needed for the coverage area, greatly lowering infrastructure costs. Multi-processor edge-based solutions thus equate to the most economical method for securing large perimeters and creating buffer zones around critical outdoor assets.

To illustrate the cost savings of the previous real-world case study, Figure 4 gives a detail cost analysis matrix which calculates the total cost difference using multi-processor edge-based sensors as compared to a typical single-processor industry alternative. This analysis includes:

- **Infrastructure:** The infrastructure cost to support a camera is the biggest expense in outdoor surveillance, typically at least \$15,000 or more per camera, depending on the construction difficulty, tower requirements, and risk. This cost includes the labor for excavation and installation of foundation and pole, and trenching for power and communications. With multi-processor edge-based sensors the number of cameras can be reduced, providing better accuracy, longer range and reliability, while lowering the supporting infrastructure requirements and associated costs.
- **Encoders/Analytic Processors:** A completely integrated edge-based approach, unlike add-on video analytics products, requires no additional servers, encoders, or peripheral equipment at the Security Operations Center (SOC). The elimination of these additional costs extends not only to direct hardware expenditures but also to the elimination of design, installation, and ongoing maintenance labor costs. These pre- and post-installation support expenditures can easily exceed the hardware costs.

- Video per-channel costs: Additional economic advantages are realized with the complete multi-processor edge-based solution when considering the per-channel cost associated with the Video Management System (VMS) used to display and archive video information. Hardware requirements for video storage are reduced relative to the number of video streams eliminated by having fewer sensors to cover the perimeter, typically by 3 to 4 times. The number of VMS and video analytics licenses required is also reduced proportionally. Consider too that a significant manpower advantage is realized when operators become more effective by having 60-75% fewer video channels to manage for the same size perimeter, and a greatly diminished false alarm/nuisance alarm rate.

As shown in the cost comparison analysis, the multi-processor edge-based solution is less than half the cost of the industry alternative. By employing a longer/wider range camera, enough infrastructure cost is eliminated to cover the 40% higher multi-processor sensor cost and *still reduce the total system cost by over half.*

COST COMPARISON ANALYSIS				
	<i>Multi-Processor Edge-based Approach</i>		<i>Single-Processor Industry Alternative</i>	
Fixed Cameras w/outdoor weather proof enclosure	10 x \$11,525	= \$115,250	30 x \$1,250	= \$37,500
Analytics Software License	included	0	30 x \$300	= \$9,000
Encoder/analytic processor	included	0	30 x \$1,200	= \$36,000
Total camera/edge detection cost (sub total)		\$115,250 (+40%)		\$82,500
Video Management Software	10 x \$750	= \$7,500	30 x \$750	= \$22,500
RAID Storage Space (GB)	3,240 x \$2.56	= \$8,294	14,580 x \$2.56	= \$37,325
Cost per Network Drop	10 x \$800	= \$8,000	30 x \$800	= \$24,000
Installation (poles, cabling)	10 x \$15,000	= \$150,000	30 x \$15,000	= \$450,000
Total Cost:		\$289,044		\$616,325
Percentage Total Savings:		53%		

Figure 4: Cost Comparison

Economic gains are not the only advantage to the multi-processor solution; reliability increases exponentially as the overall system complexity is reduced. With fewer hardware and software pieces to fail, security systems become inherently more stable, more reliable, and less costly to design, deploy, commission, and maintain.

By delivering the complete “answer” in the camera, no post-processing is required. This opens up more flexible options when the solution is built on industry protocols and open standards, eliminating the proprietary nature that has been too common for earlier video analytic approaches. More importantly, coming to a complete solution at the edge eliminates any single point of failure, providing business resilience during a disaster or emergency.

By adopting truly open communication architectures, multi-processor edge sensors can also seamlessly interface directly with most Network Video Recorders (NVR), Command and Control Systems (C²) and Access Control Systems (ACS). This also allows the systems designer to have greater flexibility in selecting the communications methods, since many forms of wireless communications can be utilized effectively, while leveraging your prior video management system investment.

Summary

Pre-emptive automated surveillance is transforming the way businesses, government agencies and systems integrators are creating outdoor surveillance solutions. Incorporating significant processing power in the sensor at the edge greatly decreases nuisance alarms, provides opportunities to leverage a wide range of communications, and delivers the “what and where” of a security event. The result is a dramatic reduction in the overall cost, but more important, *it is security you can trust.*

Information and Resources

- To perform an online perimeter security design of your facility in minutes, visit: www.sightlogix.com/sightsurvey.html
- To read more about SightLogix SightSensor technology, visit: www.sightlogix.com.
- To request a meeting with a solution specialist, email info@sightlogix.com or call 609.951.0008.

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