



WHITE PAPER

Axis and Intelligent Video (IV)

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1 What is intelligent video?

Video surveillance is a booming business, and installations become larger and larger. At the same time, several studies have highlighted the hit and miss nature of human intervention to spot change in a surrounding environment. And the challenge becomes larger as systems expand. In addition, a massive amount of video is being recorded, but never watched or reviewed, due to lack of time.

As a result, events and activities are missed, and suspicious behavior is not noticed in time to prevent incidents. This has led to the development of intelligent video (IV).

Intelligent video is about reducing the vast amount of information contained in video, making it more manageable for systems and persons. Intelligent video surveillance systems automatically perform an analysis of captured video, and automatically use the resultant data. Building this sort of analytics into network cameras creates a reliable and versatile video surveillance system, and drastically reduces workload for the staff. Furthermore, intelligent video allows the operator to use the video surveillance system more pro-actively by giving early warnings about situations that could be potential risk scenarios.

The applications performing these analyses are referred to as Video Content Analysis (VCA) or Video Analytics (VA). Video analytics range from video motion detection and audio detection, to more advanced systems including camera tampering detection, people counting, virtual fences, and vehicle license plate recognition.

Intelligent video systems can also extract video and data from surveillance video streams and integrate that information with other applications, such as retail management systems or access control systems, creating new benefits and opening up new business possibilities.

2 Why is it an important development?

Intelligent video allows video surveillance systems to be used for a host of new applications, and ensures that video surveillance systems become smarter, more accurate, and more cost-effective. In summary, intelligent video:

- Automatically analyzes and tags surveillance video in real-time
- Detects suspicious activities
- Initiates video recording, alarms or other actions
- Alerts operators or field personnel
- Enables users to be proactive – preventing crime rather than reacting or analyzing after the fact

Systems can be set up to deliver far more targeted and specific information with intelligent video. This means that in the future there will be far less reliance on manned guarding. Intelligent video also creates a platform for a more pro-active approach to video surveillance. By configuring intelligent video systems to specific parameters, it is possible to get instant alerts when pre-set parameters have been breached, thus delivering early warnings to staff.

2.1 Efficient use of manpower

Intelligent video enables efficient use of manpower. Fewer operators can monitor even very large installations, since staff will not be required to watch many monitors for long hours to spot

suspicious activity. Instead, the intelligent video system would inform operators about people moving in restricted areas, cars driving the wrong way, or attempts to tamper with the video surveillance cameras.

2.2 Faster retrieval of stored video

Video analytics – such as video motion detection – ensures that only relevant video footage is stored, so that when the need arises to search through old recordings, only video that could potentially include the event in question is retrieved. For example, an intelligent video system that has tagged the video stream with appropriate labels during recording can automatically search through days of stored video to find the right video footage in a matter of seconds.

2.3 Reduced network load and storage needs

Intelligent video systems that include video motion detection and audio detection minimize the need for storage space by recording only video that contains activity. Furthermore, by placing intelligent video ‘at the edge’, that is, processing as much as possible of the video in the network cameras themselves, the load on the network is significantly reduced as only relevant video is streamed from the cameras. Intelligent video applications help build video surveillance systems that are more cost-effective.

2.4 New business opportunities

Intelligent video also makes it possible to use video for applications outside of security. For example, in retail stores it can be used for analyzing consumer behavior, such as the number of people stopping by a particular merchandising shelf, or the popular routes through the shop. In airports, an intelligent video system could measure the queue time between entering and exiting a check-in point, helping direct staff and minimizing waiting time for travelers. In these and other ways, intelligent video makes it possible to extract greater benefit out of the video surveillance infrastructure, enabling a higher return-on-investment.

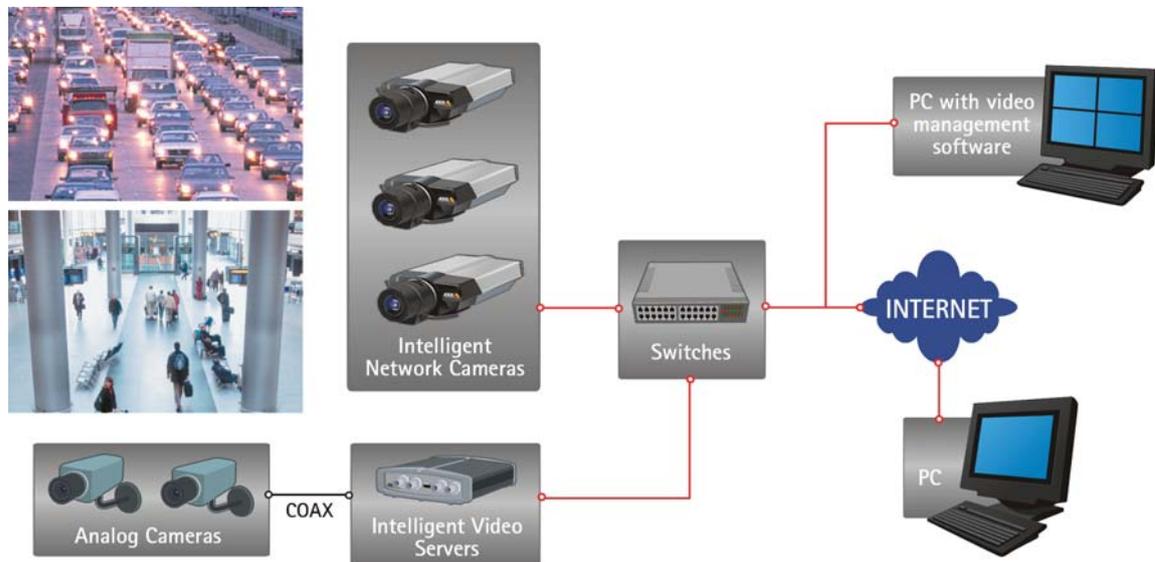
3 System design strategies for intelligent video

There are two broad categories of systems for implementing intelligent video - centralized and distributed. In centralized architectures, video and other information is collected by cameras and sensors and brought to a centralized server for analysis. In distributed architectures, the edge devices (network cameras and video encoders) are ‘intelligent’ and are capable of processing the video and extracting relevant information.

Network video allows for distributed intelligence. Distributed architectures are designed to overcome the limitations of centralized architectures by distributing the processing to different elements in the network.

If cameras for example, have motion detection, then rather than streaming all the video, only interesting video that has motion in it can be sent to the monitoring station for further action and analysis. The load on the infrastructure and people involved falls dramatically. For specialized video analytics, where only the data is needed and not the video, such as, people counting, or automatic number plate recognition – running the applications in the camera has a dramatic impact since the cameras can extract the required data and send just that information, with perhaps a few snapshots.

The most scalable, cost-effective and flexible architecture is based on ‘intelligence at the edge’, that is, processing as much of the video as possible in the network cameras, or video encoders themselves. This architecture entails the least amount of bandwidth usage since the cameras can send out data and intelligently figure out what video needs to be sent. This significantly reduces the cost and complexity of the network centric processing model, and completely eliminates the drawbacks of centralized architectures.



Furthermore, processing video at the edge – or partly at the edge – significantly reduces the cost of the servers needed to run the intelligent video applications. Servers that typically process only a few video streams when doing the entire video processing, can handle hundreds of video streams if some of the processing is done in the cameras.

A number of software vendors supply intelligent video applications that solve specific needs. Together with network cameras, video encoders and/or video management software systems, these intelligent video applications form complete solutions, tailored to specific market requirements.

While this creates great freedom of choice for the end user, it also calls for compatibility and easy integration between the cameras/encoders, video management software, and the intelligent video applications. In order to be commercially attractive and to optimize compatibility, devices, software, and intelligent video applications need to be built on open interfaces (APIs) and platforms. This creates flexibility for users and enables them to design intelligent video surveillance systems that fit their needs perfectly.

4 Axis and intelligent video

Axis is committed to enabling a great variety of video analytics for its network cameras and video encoders. Our products provide capacity in terms of enough processing power and memory to embed video analytics in these edge devices. This makes it possible to create scalable intelligent video solutions for a wide range of network video products, with diversified requirements, ranging from basic camera-enhancing software applications to more niche intelligent video systems.

Axis is also committed to providing a platform for intelligent video applications. This platform is made up of a series of economically-priced modules which will offer basic functionality which

our ADPs (Application Development Partners) can build more complex systems onto. Axis is making it easy for ADPs by not only providing these basic intelligent video modules, but also creating the facility to easily download applications on top of our intelligent video architecture. To this end, Axis is providing our freely available, industry-standard Application Programming Interface called VAPIX®. This ensures that ADPs – or other software developers that want to become ADPs – and the systems integrator community can easily access and embed intelligent video in complete video applications. Software Developer Kits and other documentation can also be downloaded from the Axis ADP partner web site. Essentially this will provide the bridge between our devices and software from the ADP community so that pilot systems can be built and the benefits of intelligent video applications explored as quickly and easily as possible.

Axis will continue to explore new ways to stimulate software vendors to build video analytics modules because ultimately the company sees intelligent video as yet another compelling reason for wider use of network video systems.

5 Axis intelligent video products

Axis offers a number of intelligent video applications that support security operators in their daily work by solving real-world video surveillance challenges. Also Axis Application Development Partners supply a broad range of intelligent video applications that work with Axis network video products.

5.1 Active Tampering Alarm

Active Tampering Alarm is an intelligent video analytics application available in selected Axis network cameras. This functionality alerts security staff when there is disrupted camera operation caused by vandalism or accident - such as redirection, blocking, or defocusing of cameras. The product is especially useful in schools, prisons, public transportation, and in harsh environments where weather, vibration, or dirt can disturb the camera's performance. Without Active Tampering Alarm, it can take a long time before tampering is noticed, particularly when one operator monitors multiple cameras.

5.2 Video motion detection

Video motion detection can either be built-in into a network video product or made available with video management software.

Video motion detection is the original, basic, and prevalent intelligent video application within video surveillance. It is primarily used to reduce the amount of video that is stored, by flagging video that has changes and eliminating video in which nothing changes. By only storing video in which changes occur, security personnel can store video for a greater time period on a given storage capacity. It is also used to flag events to operators – such as persons entering locked areas – for immediate action.

Video motion detection is the foundation for a large number of more advanced video analytics, such as people counting, digital fences, and object tracking. Axis has offered video motion detection in its network video products since 2000 and today, all Axis network video products – except the AXIS 206 Network Camera – are delivered out of the box with video motion detection.

5.3 Audio detection

Many network video cameras include audio support, though, just as in video surveillance, local legislation or codes of practice sometimes limits the use of this feature. Sometimes, using audio can be a powerful complement to video. Audio detection is based on the same principles as video motion detection. The application detects noise – such as the breaking of a window or voices – and uses this as a trigger to transmit and record video, or to alert operators of suspicious activities. Audio detection can react to events in areas too dark for the video motion detection to function properly, or detect activity that is hidden from the view of the cameras.

For audio detection to work, the camera needs to at least include audio support, and either have a built-in microphone or have an external microphone attached. The audio detection is configured to react to a certain volume of sound and send an alarm or initiate recording of the video stream and the audio, if so desired. Axis offers audio detection in all network video products that contain audio support.

5.4 People counting

In a retail store there could be a network video device installed at each of the public entrances. Network video devices can be fitted with a people counting module, which records the number of people passing through each door directly into a central business unit. Separate devices provide views of point of sale displays. Network cameras may trigger on motion and will stream this video down to a central unit, and onto an operator for analysis of "dwell times". High volumes of people buzzing around, combined with long dwell times provide a picture of the display success. This information ultimately aids the store's overall profitability.

Other important store issues are: "When do queuing levels start to impact customer experience? Is a particular line going faster than anticipated? Is there frustration around a new layout in a store?"

Network video systems can therefore serve multiple purposes - for business intelligence purposes helping retailers to increase sales and profitability through analysis of customer behavior, for improving the customer experience through analysis of queuing times and observing reaction of waiting customers, helping support decisions to open new tills as queue times reach levels where they begin to detract from the customer experience.

5.5 Partner applications

Axis network video products include the industry standard Application Programming Interface VAPIX®, which facilitates the development of customized software solutions. This allows partners to develop applications – including intelligent video applications – that function with Axis network cameras and video encoders, and ensure that users benefit from the market's widest range of third-party applications.

6 Conclusion

Intelligent video will undoubtedly fuel deployment of network video technology over CCTV and hybrid technologies. Leading industry analyst IMS Research in 2006 revised their estimate for growth of the network camera market upwards to CAGR 53 per cent (exceeding US\$1 billion by 2009) partly, as they see it, because "network cameras will have embedded video content analysis capability to detect various behaviors or events." (Source: IMS Research News – Security & ID Newsletter March 2006).

Another report valued the intelligent video market or, as IMS Research prefers to call it the ‘Video Content Analysis Software’ market, at US\$85 million in 2006, growing at more than 50 per cent annually for the next years.

Intelligent video definitely offers a host of new reasons and ways to benefit from network video and also responds to end user desires to get more from existing network video infrastructure providing business intelligence which can be used to improve the effectiveness of organizations.

7 About Axis Communications

Axis is an IT company offering network video solutions for professional installations. The company is the global market leader in network video, driving the ongoing shift from analog to digital video surveillance. Axis products and solutions focus on security surveillance and remote monitoring, and are based on innovative, open technology platforms.

Axis is a Swedish-based company, operating worldwide with offices in 18 countries and cooperating with partners in more than 70 countries. Founded in 1984, Axis is listed on the Nordic List, Mid Cap and Information Technology exchanges. For more information about Axis, please visit our website at www.axis.com.