

# Active video surveillance

How plug-and-detect could revolutionize CCTV

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*Growing use of CCTV cameras has made video surveillance of our roads a challenge. Technological breakthroughs in image-processing techniques are now greatly assisting operators in road safety and security issues*



**"Can we then afford to sit more and more people in front of CCTV screens watching traffic?"**

The features provided by Pan-Tilt-Zoom (PTZ) cameras allow flexible video surveillance of road networks. Not only can the operator choose the direction of traffic to monitor, but it also allows them to focus on specific zones of interest. They provide road operators with so much information that their use has rapidly expanded to unexpected levels.

Therefore, it is now common to see one or more operators dealing with several hundred cameras monitoring hundreds of kilometres of highways and expressways.

Images from these cameras are presented to operators on video surveillance walls. By monitoring for example 10 screens on which 100 cameras are cycled, operators are supposed to take in all this information with a view to spotting abnormal traffic situations.

## The reality

Most of the information provided by CCTV cameras is under-used or not used at all because traffic operators are not aware of it in good time. Behavior studies clearly show that the ability of an operator to focus on his traffic monitoring task decreases with the time and with the number of screens to monitors.

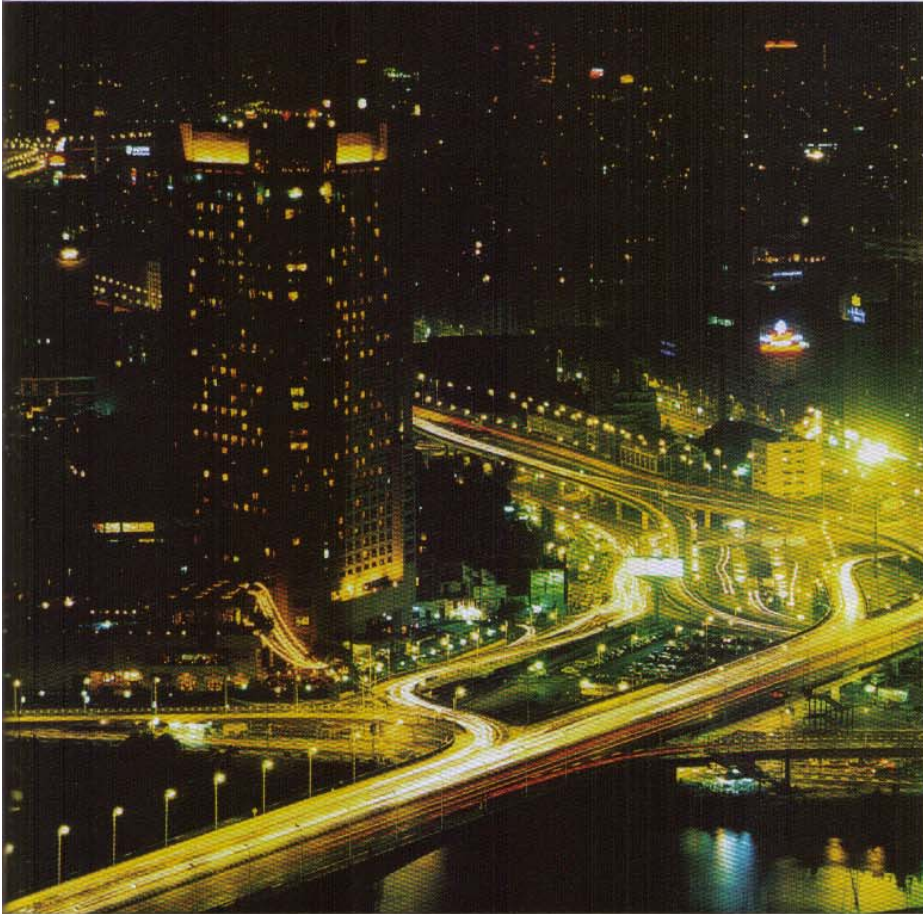
Therefore, all the information available from these PTZ cameras is either not presented to operators or not seen in good time.

## An efficient use of resources

This issue can be addressed in several ways. However, if we consider that traffic monitoring is crucial for mobility, safety and security issues, it is extremely unlikely that we'll see the number of CCTV camera decrease in the years to come.

Can we then afford to sit more and more people in front of CCTV screens watching traffic? The challenge is to reduce the quantity of information presented to operators at the same time as improving its quality, by inviting them to look at pertinent images rather than rigid pre-programmed cycles of video images.

The key is truly about making more efficient use of our human and technological resources. Most of traffic situations worth paying attention to deal



with stopped vehicles or are directly related to stopped vehicles.

The idea is then to provide a system that will warn operators of any vehicle stopping within the field-of-view of an existing given camera.

Over 90 per cent of traffic cameras are pan-tilt-zoom cameras. They are heartily approved by operators because they enable them to watch traffic and road infrastructure from various angles, from far away or from close-up.

### Plug-and-detect: a breakthrough

The solution for systems to assist operators in monitoring traffic is a real breakthrough in the field of video image processing. The development of new algorithms capable of learning traffic patterns enabled the design of a detection system that does not require any configuration or calibration.

The image processing algorithm analyses movement within the frame and

automatically spots any stopped trajectory in the image.

Any movement of the camera: zoom, pan, or tilt is immediately followed by a self-learning process performed on the new field-of-view. In the most difficult situations, it takes the system a few seconds to be operational after a camera movement. As the system does not require any calibration and directly applies image processing algorithm to any video signal plugged in, the system is truly 'plug-and-detect'.

Analysis performed by the system is fully automatic and permanent and all pictures are analyzed in real time.

### Active video surveillance

The system works in the background on all pictures of the network, 24 hours a day and regardless of the position of the pan-tilt-zoom camera: whether zoomed on a specific area hundreds of meters away from the camera standpoint or looking at wide areas.

The system therefore provides true assistance to the operators, only attracting their attention when necessary. This concept can be referred to as 'Active Video Surveillance'.

With such a tool, the operator can concentrate on other jobs than pure surveillance of screens. All pictures are analyzed in real time.

**"Analysis performed by the system is fully automatic and permanent and all pictures are analyzed in real time"**



Customizing the system: morning and evening rush hours, night shift



#### Stopped vehicle detection

However, once alerted the operator can then select appropriate pictures through the CCTV system and use the PTZ cameras capacities to focus on the zone where something happened.

Most incidents occur on sections of highways and expressways particularly difficult to monitor, such as: bridges, viaducts, interchanges, large intersections. These key infrastructures are important to monitor not only in terms of safety but also in terms of security. They need to be looked at from various angles.

The ability of the system to self-adapt to any kind of road infrastructure, as well as to cope with any position of the CCTV camera makes it a perfect fit for these complex infrastructures where traffic flows in several directions.

#### Measured performances

The plug-and-detect system has been widely field-tested on over 100 PTZ cameras' views at different sites including bridges and interchanges, under various traffic conditions (fluid, stop and go, congestion), under various camera settings and under various weather and lighting conditions such as day/night, dry/rainy and sunny/cloudy.

The system has picked several hundreds of stopped vehicles. Vehicles were signaled to the operator within a few seconds following the stop.

#### Recording events

For each camera analyzed, the system keeps digital pictures in a buffer. This feature provides a permanent digital recording of the images from all the cameras of the system.

It allows an operator to manually retrieve the digital recording of any

moment within the previous days without the need for additional digital recorders. The system may also automatically save a video sequence attached to each and every incident for which the system alerts the operator.

The operator can then immediately display the sequence before and after the detection to evaluate the cause of the incident and the following phase.

This function is a powerful tool to quickly understand situations (incidents, accidents) occurring on the road either in order to assess the type of rescue teams to be called, or after for a deeper analysis (official inquiry, behavior of road travelers during and after the incident...). All video sequences are stored in a database.

#### Customizing for efficiency

The plug-and-detect technology provides a true flexibility of the system and makes it insensitive to PTZ cameras movements.

However, operators tend to focus on different cameras depending on the time of day: morning and evening rush hours, night, day, weekdays, weekends or holidays. Therefore, the system needs to be flexible so as to change the cameras fed to the system depending on these various criteria.

As the system self-adapts to any field of view, it can handle these changes automatically. It may even be fed with more video signals than the video image processing can handle simultaneously and process only a number of these signals.

Upon command, the system will automatically switch the video signals processed. This command may be initiated manually by the operator, automatically by a central computer or by

programming the plug-and-detect system.

The system thus performs video switching on the top of its detection functions and ensures flexibility and evolutivity.

It is also customizable for each operator or category of user (day and night shifts for example); i.e. different profiles can be defined with different groups of cameras handled by the system.

#### Keeping an eye on CCTV

The system not only warns the operator of events occurring on the roadway, it also warns of problems on the CCTV system itself, thus relieving the operator or the maintenance team from constantly monitoring the equipment. The system warns of absence of video signal or bad signal quality.

The system may also signal a PTZ camera focusing on an area devoid of traffic for a given amount of time.

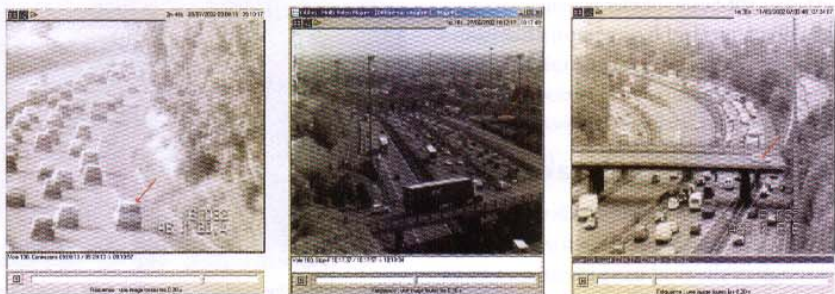
#### Active video surveillance

Plug and Detect systems provide hassle free cameras operations and monitoring. This new concept of Active Video Surveillance then consists in a system working in the background on all pictures while the operators are focusing on other tasks and are ready to take over in case of incident signaled by the system.

This results in a better use of our resources enabling operators to concentrate on true security and safety issues instead of monitoring screens.

This technology allows to conciliate the growth of our traffic monitoring systems while keeping their efficiency at the highest level. ■

For more information, see [www.citilog.com](http://www.citilog.com)



Using the Pan-Tilt-Zoom abilities to focus on an incident