

Video Incident Detection White Paper Nick Hewitson

CCTV is widely used across the UK Motorway network and to a lesser extent on the All Purpose Road network. Most of the cameras are PTZ (pan/ tilt / zoom) with a limited number of fixed cameras. The video is digitised near the camera and transmitted back to the regional control room via the National Road Telecommunications Service (NRTS) where it can be selected for display by the control room staff.

Most of the cameras on the network are not being viewed at any single point in time, which reduces their return on investment, due to other priorities within the control room.

Video Incident Detection (also known as Video Analytics and Video Content Analysis) uses computer algorithms to process the video from the roadside cameras and to bring to the attention of the staff in the control room events which might need acting upon. The aim of systems today is as an operator assistance rather than a fully failsafe solution.

One issue with using the existing PTZ camera infrastructure is that the software will be set up to identify incidents within a specific camera field of view. If the camera has not been returned to its exact home position then the reliability of the system will be diminished, obviously if the camera is left in a position looking at the sky or the field beside the road then the system will cease to work completely.

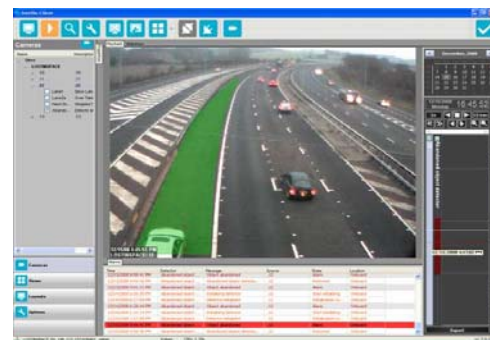
Video Incident detection therefore has two distinct architectures: Using specifically installed fixed cameras, which are often smart cameras with the image processing built in and solutions which use the existing camera network and which also alert if no traffic has been identified for more than time t.

The determining factor on which of these is the best architecture to use is usually defined by what existing infrastructure is in place. This is in terms of cameras, power and communication systems.

We will look at both potential options in more detail.

Fixed Smart Cameras

We have installed a number of smart cameras on the M20 motorway in Kent. These cameras have been set up to alert if the traffic congestion builds up, if vehicles stop on the Hard Shoulder or if a vehicle is proceeding in the wrong direction.



Smart Camera Video incident detection on a UK motorway

The picture above shows an alert from the system, a car has stopped on the motorway hard shoulder.

This system has been in continual use for over two years and has therefore had to deal with all of the weather effects which are found in the UK. Obviously for any video based technology if the camera can't see what events are occur it will fail to alert. In order to provide 24 hour coverage the sections of motorway are covered with Infra Red illumination so that the cameras can see in the dark (this is an unlit section of motorway).

Normally the false alarm rate is acceptably low, below one false alarm per camera per week, however issues cause with the reflective strips on motorway cones reflecting significant amounts of light into the camera at specific times of day can cause an increase in the false alarm rate during periods of road works.

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Existing Analogue CCTV

We have designed a number of systems which reuse existing CCTV infrastructure, in both in Highways and Public Space environments. Key issues when using existing CCTV revolve around:

The placement of the cameras; what is deemed to be a good position for a human may not be a good position for computer analysis. For example a human viewer will recognise that an object is a person or a car even after they have passed a survey point and include them in the count. While a computer has to segment the image (find the object of interest from the background) and classify it before it reaches the survey point in order to include it in the data set. Often standard CCTV is not set up to give sufficient time for the computer to achieve these tasks before a junction count for example is required.



Image processing from existing CCTV infrastructure

The quality of the video, both in terms of the actual video quality and more importantly the size of the object to be identified within the field of view. A person can make a determination on a much smaller object than the computer will do reliably.

In addition existing CCTV has often been poorly installed and maintained so it is often a false economy to try and reuse the infrastructure which is already in place.

Conclusion

Video Incident Detection systems are a real solution which is deployable today. In addition to alerting on incidents the technology can be used to obtain survey data, how many vehicles of what size in what time etc. The key challenges are in the deployment (camera angles, lighting, data transfer) rather than the core technology which is where specialist companies like Smart CCTV can provide a turnkey solution.



Installing a temporary video incident detection system for a traffic survey

Video however has a major advantage (along with radar) over the most common form of road sensor, the inductive loop. Video is an "above ground" technology, in other words changes to the placement of cameras, moving counting lines etc. doesn't require the closure of the carriageway.

Video also has the ability to monitor up to 150 meters of road from a single camera, loops are a point sensor and most radar sensing areas are only a few meters in length. These can make video a very cost effective solution to deploy in the field although care needs to be taken to determine what sensor technology or combination of technologies is optimal for a given task and location.

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