The World of mobile video surveillance and vehicle tracking - CCTV, MDVR, GPS, GPRS, 3G, HSDPA,CMS, HDD, SD, CAN, OBD, GEO fencing, CIF. H.264 – helping you to untangle the alphabet spaghetti and decide what you need, and if you need it.

Vehicle tracking has been with us for several years now, the technology is familiar to all of us who use our Sat Navs or Tom Toms to get us from A to B. GPS (short for global positioning satellite) simply relies on an antenna to receive location information (longitude and latitude) from a group of satellites orbiting the earth. Basic vehicle tracking systems then just transmit this location information back over the mobile phone network. These 'black boxes' can also send back vehicle speed information.

In parallel with these vehicle tracking developments, mobile CCTV has come on leaps and bounds. Closed circuit TV is perhaps an outdated terminology for such equipment but it is firmly in our day to day vocabulary nowadays. CCTV was first used on buses and other forms of public transport, and originally that is all it was, one or two cameras with a video monitor for the driver to see what was happening on his bus, for instance upstairs on a double-decker or at the back of the vehicle to aid reversing. CCTV was then upgraded with tape based video recorders then lately digital video recorders which store video footage onto hard disc drives or memory cards.

Standards

Digital video recorders were made possible through the development of recording standards that allowed the compression of video to a much smaller memory size than would have been previously needed, for instance where there is no movement in the image then the video recorded will use next to no memory, similarly if there is a small amount of movement the system will record only what is moving, not what is still – again saving memory. In comparison the old analogue audio tapes would keep rolling regardless of lack of movement in the image. The latest standard for video compression is H.264, which is also known as MPEG4. This supersedes the older MPEG2 standard and is reported to give around double the compression on average, i.e. you can record twice as much within the same memory using this latest standard. The length of the video footage that can be stored in memory is variable according to the amount of movement, therefore you will only see 'typical' recording time capacities quoted. Something else to look out for is recording quality, the lower the resolution of the image the longer the video recording time. Resolution of video images is normally given in terms of CIF – common interchange format; 1-CIF is 'medium quality' and is normally well accepted for CCTV applications; a higher resolution is known as D1 but this is for high end systems. You also need to look at frame rates, the number of images (frames) stored per second – fps, recording time increases as you store less frames per second. 30 fps is normal video speed; 8 fps is often acceptable for CCTV.

The advent of Digital Video Recorders (DVR's) often referred to as MDVR's (M for mobile) has created a sea change in the use of such equipment. MDVR's are small, the size of a car radio or less, and reliable. The use of digital technology means that more and more features can be incorporated into the same unit.

Types of video storage

There are 2 main storage options hard disc drive and SD card.

Hard disc drive (HDD), the hard disc can be up to 500 gigabytes in storage, they are standard 2.5 inch SATA drives as found in note book Pac's. Higher capacity drives aren't recommended. The amount of data that can be stored depends on how many cameras you have, the resolution (number of pixels) you are recording at and the number of frames per second. In our experience with a typical set up this is around 4-6 weeks of storage. The hard drives are mounted in a shock absorbing cradle and the mobile DVR in turn is normally mounted on an anti vibration bracket. Failures do occur however, for this reason some units also have an SD card slot to record recent video information at the same time as it is recorded onto the hard disc – i.e. 'mirrored'. The video footage is transferred in one of two ways; on many units the hard drive is in a cartridge that can be removed then plugged into a PC using a USB cable, on some units segments of video can be transferred onto a standard USB memory key.

SD card based systems use standard SD cards as used in digital cameras etc, up to 32 gigabytes is supported which is typically 1.5 to 2.5 days of storage. SD card storage is inherently more reliable than hard disc storage. The downside is that it needs the discipline of downloading (copying) the memory card every night. The effort can be reduced by swapping the card for a fresh one but you wouldn't want to carry too many of these cards in the archives due to their expense. For users who don't have the discipline to download every day, or can't because the vehicle is on long journeys then hard disc storage is normally the answer.

The format of the video recorded varies between manufacturers. Typically hard disc drive units use a proprietary standard, PC software is normally provided free of charge with the MDVR. On SD card slots the video is often to a standard PC format that Microsoft Media Player and the like can support. There are pros and cons in having standard verses proprietary formats, the latter offering more security and privacy protection. Video footage is often 'watermarked' on the DVR with a hidden electronic signature linked to the identity of the DVR in question. Footage is invariably time and date stamped to further increase the credibility of any footage used as evidence.

The numbers of cameras used is down to the users requirements and typically ranges from 1 to 8, and even more in some cases. The cost of an 8 camera MDVR is more than a 4 camera one, in addition there is the cost of the cameras themselves and the associated cost of installation and cabling. The location of the cameras is down to the customer's business needs. A typical configuration is one pointing out through the windscreen covering the driving view of the road, and one covering the vehicle loading door. Further cameras can

cover the front, rear and side views from the vehicle and additional loading doors. The use of cameras within the cab is a sensitive one but is a key requirement in some applications. For passenger transport cameras can also monitor gangways, doorways, staircases etc.

The mobile DVR's can also record events, examples of events are doors being opened or an impact sensor being triggered due to a crash or incident; panic buttons can also be installed. This is convenient when viewing the data as the user can filter the video footage just to look at video associated with such events. Some DVR's can also be linked to the electronic 'brain' of the vehicle to record fuel consumption, engine information and so on – this is achieved using CANbus, CANbus (controller area network) is the worldwide standard for vehicle communication. The connector the DVR is plugged into is known as an OBD connector (on board diagnostics), this is the connector the service technician plugs his or her diagnostic box into when you take your car for a service.

Then there is the option to 'stream' the video over the mobile phone network. There are three cost elements to this, the additional cost of the MDVR hardware, the cost of the airtime and the cost of someone monitoring the video. For many users a stand alone system gives them what they need, for a smaller percentage the on line video is essential. Near real time streaming of video needs the latest 3G (third generation) mobile phone network

On line real time tracking of vehicles is a real 'wow' feature when such equipment is being demonstrated and sold. Often the customer will purchase a large screen TV and will gaze intensely at his vehicle movements on the screen, then like most boys toys the interest wanes and the novelty wears off. Think very carefully about whether you need real time information and whether you have the resources to use it. Real time systems can be helped through various alerting tools like geo fencing, geo fencing sounds fancy but is simply an alert that is generated (e.g. via an email, SMS or on screen warning) if a vehicle goes outside a specific area - you literally just plot a geographic 'fence' on the map. That way is a vehicle strays off its route you know straight away. The software used centrally to monitor the video footage and vehicle location is normally known as CMS, central monitoring software. Standards are now emerging for linking CMS to DVR's, the main one being, 'onvif' the advantage of such standards is that in theory you can mix and match different vendors equipment.

There is also an option for GPS tracking of the vehicle which is taken up by most users. In a simple application the GPS information (longitude and latitude) is overlaid on the video being recorded. It can also be stored in a time and date stamped log file. Where the customer has the streaming video option the location of the vehicle can be shown real time on Google Maps or similar. Some MDVR's are equipped with WiFi, wireless internet, which enables them to download video and data automatically when reaching the depot at night, this is often a good, low cost compromise between real time and stand alone – it does rely on the vehicle returning 'home' each night though !

So what are the benefits of all this technology? As with all technology you have to look at it the other way round and define your problems or needs. See if you can identify with some of the examples below:

- Ensure vehicles are being used efficiently, that they are keeping to specified routes and destinations, and timings, and that they are not being left parked for excessive periods
- Identify the causes of accidents in order to reduce insurance claims and to identify poor driving behaviour
- To reduce theft, under delivery and over delivery of vehicle contents by monitoring the loading and unloading of goods
- To monitor driving behaviour, including speed, harsh braking, excessive fuel consumption in order to make improvements through training, awareness and discipline.
- For public transport to identify anti social behaviour, vandalism and bogus personal injury insurance claims
- To monitor cash collection, issuing of receipts, paperwork and tickets.

Some questions to ask yourself. Before you get inundated with sales people and high pressure mind boggling demos, ask yourself some simple questions:

- Do I need video? If so how many cameras and where?
- How long do I need to store video on the vehicle for, and do I have the opportunity and or the discipline to download video and data every night?
- Do I need real time video, can I cost justify it in terms of airtime cost and the cost of monitoring the video footage centrally?
- Do I need vehicle tracking, and if so does this need to be real time
- Do I need any other information, such as vehicle impact, speed, door opening etc.

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