# Integrating Digital Image Processing With Retail Oil Industry Business Processes

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## Abstract

Analogue video recording systems have traditionally been limited in functionality and their suitability for uses beyond basic surveillance tasks. The evolution of digital video recording has led to the realisation of much greater potential to integrate video with a wide variety of business processes within large organisations such as retail oil companies and provide a great return on investment.

Smart Surveillance Technologies are a company taking advantage of the developing potential of digital video to integrate systems of maximum benefit to their commercial customers.

## Video on a Gas Station

Placing video cameras onto gas station forecourts is not a new concept, but it is also a concept that has not gained widespread adoption. Why not? The use of video monitoring on a gas station forecourt can provide the company with numerous benefits in terms of the information that can be gathered from this footage. Security is the obvious advantage, with the footage being used to identify criminal behaviour, as well as create a deterrent through the visible presence of cameras. In addition, video footage can indicate what type of vehicles use particular dispensers, and could even be used to identify a fleet vehicle for billing transactions to an account. For marketing, identifying the customer by their vehicle could lead to personalised offerings at a forecourt service terminal, or could be used for the accumulation of purchasing behaviour data for a particular customer over time.

But such benefits are reliant on one key factor: technology. The practical technology to support the theoretical benefits simply has not been realised. Until now. Traditional analogue systems are being superseded by digital systems, and a wealth of new opportunities and possibilities are being opened up to oil companies for integrating video into their business systems and processes.

## Digital Killed the Analogue Star

Traditionally, video systems have consisted of one or more cameras, connected to an analogue Video Cassette Recorder (VCR). The VCR unit records the camera footage onto videotape, which is housed in those familiar, bulky, black videocassettes. The cameras tend to be fixed, and there are either multiple cameras (arranged to cover various fuelling lanes) or one "overview" camera, with a wide-angle shot of the whole gas station forecourt. Such traditional systems, however, are fraught with problems.

First, and most fundamentally is that analogue video systems cannot provide any form of analysis of the images they obtain. The system merely captures footage, without any intelligence as to what the content of the footage is. Human interaction is required, which means an actual person has to manually look through the video footage after the event to analyse it. Such a process is not only time-consuming, tedious and expensive, it also means the video system is forced to only be reactive and can provide no real-time response to events within its field of vision. Traditional analogue systems are 'dumb' in this regard.

A result of this is that current systems provide no return on investment. Even if the system manages to capture clear footage of a drive-off event, where a customer leaves the gas station without paying, the cost of searching the footage to locate the license plate number and tracking down the offender is exorbitant relative to the value of the actual theft.

There are other disadvantages from using analogue systems. The footage is stored on videotape, which means that it deteriorates over time and is subject to damage from a wide variety of environmental conditions. The cost of maintenance of analogue systems, as a result, is very high.

Up to 24 hours can typically be stored on one VHS tape, but this still means a large amount of storage space is required for several months of data, even from a single site. Video footage cannot easily be distributed; either the tapes must be copied and physically sent or else the footage must be somehow broadcast for re-recording in other locales. Analogue footage cannot be easily searched through, even with reasonable and accurate labelling of tapes, and there is no means for a selective search on criteria within the field of view.

But a solution to these problems is now available. The advent of commercially available digital video recording equipment means that the ability now exists to not only overcome these obstacles, but also to integrate the use of video systems into a full business IT strategy.

## A Digital World

It is a fact of life that technology is continually evolving, at an ever-increasing rate. The field of video is not immune to such forces of change, and the new wave of evolution is digital video.

Digital video is a technology that, whilst not new, has only gained widespread acceptance in the commercial surveillance industry relatively recently. In a similar way that digital music on compact disc replaced analogue vinyl records and cassette tapes, DVDs are now rapidly replacing analogue videocassettes as the consumer video storage medium of choice. Long-held arguments over the quality of film over digital media are being eroded to the point that filmmaker George Lucas has chosen to shoot the hugely anticipated next chapters of his mega-budget "Star Wars" movie saga purely digitally.

The key advantage digital video provides over traditional analogue equipment is the ability for the images to be processed by computers. This allows for the video data to be compressed, meaning a large volume of footage to be stored easily and in a compact manner on commercially available components like PC hard disks.

In addition, the applications of image processing on the footage itself provide a myriad of opportunities for obtaining additional value from the video data. While the drawbacks of traditional analogue systems mean they are relegated to being used solely for surveillance purposes, digital systems allow video to be used as a major tool for business information gathering.

## Maximum Integration, Maximum Benefits

The use of digital systems means that computers can treat video images as if they were any other type of data. As a result, video images can be processed mathematically, in the same way financial or other, more traditional business data is processed. Video systems can be integrated into an entire enterprise, as opposed to the traditional single-site use, and form part of a holistic IT strategy.

The real-time analysis of video frames through digital image processing techniques allows for the potential of objects such as vehicles to be identified, even to the point of a computer "reading" a vehicle license plate. Such systems could then be used to identify a vehicle before a customer has even begun fuelling, allowing the possibility of pre-emptive activities such as customer-specific marketing, or even payment by vehicle identification.

Integrating video systems into transaction processing in this way allows video to act as a non-invasive replacement for radio frequency transponders as a method of payment. Transponders require technology to be issued and fitted to vehicles, resulting in a high-cost, low-security and administration-intensive method of payment. A video payment system, however, would require no fitting of technology to the vehicle and would only rely on keeping updated with the current vehicle owned by a customer. Such a system would also be particularly well-suited to use with commercial fleet vehicles.

Digital video technology provides the ability to include video data in any of a wide number of business processes. The potential exists for video systems to be as ubiquitous as the way barcode scanning technology is now an integral part of stock management processes.

## So Why Hasn't It Happened Yet?

Digital video is not new. Digital video systems have been in commercial use in business for a few years now. So, with all this raw potential for business advantages, why is the technology not more widespread?

As with any technology being developed, there are numerous teething problems until a certain level of maturity has been obtained. The first generation of digital video products were effectively just digital versions of the analogue systems, inheriting many of their problems. Vendors looked to provide complete, end-to-end solutions, which resulted in closed systems. Integration was extremely poor, due to the proprietary nature of the systems. Now that the market has begun to expand, vendors can supply specific system components, with open interfaces. This means that the industry has developed to the point that systems integrators can combine the best components into proven systems with open standards for maximum integration into business processes.

Digital video has also been reliant on the development of complementary technologies. For example, video data requires a large amount of hard disk storage space compared to textual or numerical data. But now, with the development of advanced compression algorithms and very large commodity hard disks becoming commonplace, what was previously an insurmountable obstacle is now easily accommodated. Similarly, controllable pan-tilt-zoom (PTZ) cameras, previously manually operated, have now been integrated into automated systems. This reduces the cost of such a system that would previously require multiple cameras, and gives a digital system the ability to react to events and conditions to provide the optimum picture.

Both the industry and the marketplace have now advanced to the point where digital video systems are poised to realise their potential as an integrated part of any business IT strategy.

## More Than Just Surveillance

Digital video offers a number of potential uses within an enterprise-wide business process. A system that is monitoring site network communications for the reasons of controlling a camera is also able to store this data associated with the footage being recorded. Similarly, digital image processing allows further business data to be obtained from the images themselves. This means that gas station network events such as nozzle lifts and fuel dispensing can have digital images of the given activity stored with the other event data. A fuel dispensing event can be logged with the POS transaction data indicating the amount of fuel dispensed, at what time, for what price, and then also include video images of the vehicle and person involved.

The use of digital video allows for greater options in terms of the storage of the video information and methods of accessing it. Selected images, or periods of footage may be indexed upon any of a number of aspects of the recording, as the images may be held in a database like any other type of business data. Combined with image processing, this means that only desirable footage need be stored and it may also be rapidly and precisely located, even under a variety of search parameters.

Digital images can also be compressed using a wide number of accepted compression techniques and standards, meaning large quantities of high-quality footage may be stored on CDs, DVDs, hard disk drives, or other mass-storage media. In addition, image quality can be reduced to allow for further compression and more efficient use of storage media.

Digital video also offers advances in the more traditional field for video cameras on retail sites: surveillance. Image processing means that a moveable camera can be manoeuvred to obtain the optimum shot, adjusting for lighting conditions, distance, or other factors. Advanced processing techniques can allow the system to identify objects such as vehicles, and adjust the camera to capture a clear image of the license plate, for example, or a clear image of a customer at a dispenser.

The responsiveness of a digital video system can also allow such security methods as blacklisting cars to be initiated. Since the license plate numbers of vehicles involved in drive-off incidents can be identified by the system, these vehicles, once added to a ‘blacklist’, can then be identified whenever they arrive on that or any other site. The system can be proactive in this regard, identifying such vehicles while they are still on the premises. The publicising of such a system also acts as a deterrent against further drive-off occurrences by other individuals.

Fleet vehicles can be identified, allowing the use of a fleet card for payment to be matched. This ensures that fuel paid for by the fleet is being delivered only to fleet vehicles, and can provide a fleet operator with full records of fuel transactions and fraudulent activity with fleet accounts.

## R&D Technology Solutionz

R&D Technology Solutionz (RDTS) are a company based in New Zealand who are working on the integration of digital video systems into the retail oil industry. RDTS are involved in the integration, development and deployment of systems in a number of countries across the globe.

RDTS have developed intelligent camera control and digital image analysis, utilising events on a gas station forecourt to control a moveable camera, ensuring optimum source image quality. Such events include nozzle lifts and replacements at fuel dispensers. As a result, the footage can be stored with associated data including the localisation of the event on the forecourt. The captured video images are then analysed for vehicle identification information.

## Contact

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