Supporting security

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Programmable solutions boost video security systems by helping them to address future needs.

By **Alexandre Maupas** and **Jean-Marc Charpentier**.

The world of video security is experiencing extensive change and as the mass market grows, so do the technical challenges. These include: reducing the quantity of data transmitted whilst keeping the same level of information; greater operational flexibility, such as bit rate and usage conditions; and interoperability, to allow deployment anywhere.

These challenges are being met by solutions based on digital technologies. Audio/video compression algorithms allow high quality images to be transmitted at low bit rates, whilst high performance programmable solutions offer flexibility and real time digital processing of a multimedia stream. And these applications use a universal communications medium – the internet.

However, whilst video security is retaining its modularity, system intelligence is no longer concentrated in one location. Instead, intelligence is being distributed amongst system peripherals. So, video cameras not only capture video, they also manage audio/video compression, handle streaming over the IP network and take decisions about image resolution – all in real time!

Technological progress in programmable solutions and audio/video compression, is making those systems possible. Building on this, Texas Instruments and Ateme have created a development platform dedicated to video security over IP – or VSIP – applications.

The platform is a complete reference design kit, including a board based on Texas Instruments’ TMS320DM642 digital signal processor and the software ‘bricks’ needed to develop a video security application quickly – such as compression, streaming and motion detection.

Unlike an asic based system, the programmable solution offered by the DSP brings flexibility, with audio/video processing handled by software. This enables the product to evolve quickly alongside technological progress: for example, the codec can be changed easily and software updated remotely. The programmable solution also allows code written in C to be changed rapidly and adapted to the application.

For instance, if the network can support variations in terms of bit rate, the Mpeg4 encoder can be specified for variable bit rate mode operation. If not, then constant bit rate mode can be selected. Moreover, the DM642 – based on a TMS320C64x core – is the best compromise between performance and cost in terms of programmable solution and its three video ports and an integrated 10/100 Ethernet interface help to minimise board size.

The VSIP hardware platform also includes a 30Gbyte hard disk, allowing an IDE interface to record and replay a video stream at up to 10Mbit/s.

Taking advantage of algorithms

VSIP uses the Mpeg4 and adaptive differential pulse code modulation (ADPCM) compression algorithms. Mpeg4 enables a low bit rate and a high quality image; for instance, a full D1 resolution image of 720 pixels per line for 576 lines (PAL) can be compressed into a data stream of around 1.5Mbit/s. By comparison, the same stream compressed to Mpeg2 standards at the same quality would require a bandwidth of 6Mbit/s.

Mpeg4 is a widely used compression standard, ensuring system interoperability, and every standard player supports this format.

With audio, the aim is to get good quality sound whilst minimising the CPU resources taken from the DSP. ADPCM allows this type of compromise, with less than 1% of CPU load required for acquisition, compression and streaming the audio.

Audio can be very useful in a security system, since sounds can provide clues. For example, an audio edge detection feature can be added to the VSIP so video recording starts when a sound is detected.

Accessing multimedia from any location is one of the toughest video security challenges. The development of internet based technologies means a boundless broadcast network is available, along with numerous web based IP tools. That’s why video security systems must be able to stream over IP in order to ensure compatibility with all network devices, such as PCs and routers. Any PC connected to the network can be transformed into a system control station if the user is authorised through log in and password management), ensuring huge flexibility in managing the video security system.

Much work has been done to address the problems of transmitting multimedia content over IP. The result is software stacks that ensure the multimedia content is streamed and displayed at the right speed, whilst maintaining audio/video synchronisation. Three communication protocols, based on TCP and UDP, have been developed to provide the stream to one or more users – the Real time Transport Protocol (RTP), Real time Streaming Protocol (RTSP) and RTP Control Protocol.

VSIP integrates these protocols to guarantee a high quality display stream and control to the user, with audio/video synchronisation in the case of lost data packets, multiuser management, bandwidth adaptation and remote control. This makes the IP stream generated by the VSIP fully compatible with every standard player that can receive multimedia content from the web.

No need to redesign the system

A programmable solution means features can be easily added to the application without the need to redesign the whole system. To make this possible, the VSIP offers dedicated video security tools, such as motion detection, video filtering or on screen display. Thanks to a software abstraction layer (framework), users can customise applications quickly according to their needs.

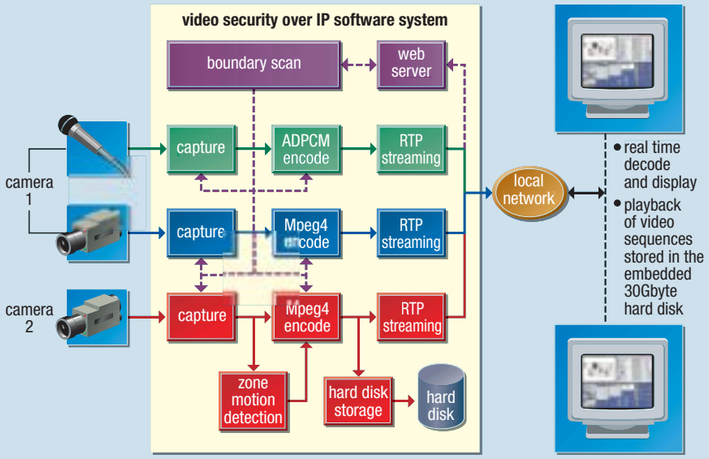
Let’s imagine a video security system for a car park (see figure 1). Two video cameras must be installed – one at the car park entrance, the other in the car park itself. The entrance camera, which allows a remote attendant to authorise access, must acquire, compress and stream audio and video.

VSIP is an ideal solution for this kind of system. For the entrance camera, audio and video will be compressed and streamed in real time on a local Ethernet. With a custom PC application, any authorised person can see the driver seeking entry and identify their voice, then decide whether to allow access.

The car park camera, meanwhile, only records data when movement is detected. Data is recorded at full D1 resolution to allow the identification of a number plate. The RTP/RTSP playback functions allow these sequences to be replayed later.

The person in charge of system maintenance can modify the parameters dynamically through a web page using a HTTP server to adapt the display to the current needs (including IP properties and bit rate). Finally, the embedded web server provides a web page to change the acquisition and compression parameters and to make those changes in real time.

Figure 1: A potential VSIP application



Addressing the future

Video security systems with a programmable component will provide efficient, flexible and interoperable solution in the future. With audio and video compression technologies evolving constantly, it makes sense to be able to change compression strategy.

Similarly, IP infrastructures are developing rapidly and the available bandwidth increases daily, so being able to adapt a system to the bit rates supported by the network ensures high quality video is always available. Moreover, IP technology enables users to interact with the system in real time, thus reducing running and on site maintenance costs.

And emerging technologies for portable equipment and wireless (WiFi) offer new and innovative prospects, such as being alerted in real time (via SMS or email), anywhere of an alarm, being able to see what is going on and even, maybe, recording the event remotely. NE

Author profiles:
Alexandre Maupas is VSIP product line manager with Ateme. Jean-Marc Charpentier is DSP catalog business development manager with Texas Instruments.