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INTERVIEW

Each Pixel Is a Camera

Vlado Damjanovski on Camera Quality

Vlado Damjanovski is known to the international security industry as a leading CCTV expert. He has written three books on the subject, and all have been rated as best selling books on this subject, translated into several languages. Furthermore, he is doing international seminars and actively participates in writing standards for the Australian industry.

GIT SECURITY + MANAGEMENT: Vlado, where does your love for CCTV come from?

V. Damjanovski: I think my love for CCTV comes from my involvement in photography since teenage years. I was very passionate about photography, and I think I still am. Although I studied Electronic engineering in Macedonia, the passion for photography has given me a different, but important view on CCTV cameras associated with the image quality, lenses, scene selection. These days there is almost no photographer that doesn't use digital camera, and everything relies on either CCD and CMOS imaging chips, both types of which we find in CCTV.

Although you are a CCTV specialist, your very own narrow specialisation is really in imaging chips. How did this come about?

V. Damjanovski: I have been learning and studying imaging chips since my university days, long time ago. My diploma work was on CCD chips, back in 1981, in the days when almost nobody knew about these imaging chips. At that time imaging tubes were used in all cameras, both television and CCTV. I was then convinced that CCD solid state imaging chips will become industry standard in the years to come, and that's exactly what started happening somewhere near the second half of the 1980-es.

But today a lot of people talk and use CMOS. So what is the difference?

V. Damjanovski: CMOS stands for Complimentary Oxide Semiconductor technology. This is a known process in microelectronics which is used during the production of microprocessors and complex semiconductor circuits. Only in the last few years it has been used widely in making imaging chips based on this manufacturing technology, hence we call it simply CMOS. This is the "new kid on the block" which is slowly overtaking the CCD technology.

Is there any particular CMOS design in CCTV you think separates from the rest?

V. Damjanovski: Probably the most impressive design in my opinion at the moment is the way Pixim makes their CMOS chips. Perhaps most of your readers would have heard about the Pixim's concept "each pixel is a camera", but I am not sure that they all understand the real practical function and meaning behind it. So, this is how I can explain it: A normal CCD camera analyses full frames (or better said TV fields) of images and checks how much light reaches each and every such frame. This information is then fed back to the camera electronic that drives the electronic exposure (some people call it electronic shutter) of the whole image and then this information is read-out, line by line, field by field, making the known video signal, 50 field, or 25 frame, each second. Now, the most important thing with modern solid state chips is that they have reasonably small dynamic range compared to human eye. This includes both CCD and CMOS as well. On normal room temperature this dynamic range is somewhere around 3,000 to 1. This means from the brightest exposure in the same frame to the darkest there is only a ratio of about 3,000 to 1. Expressed with the electronic language this is equivalent to 60dB. In real life CCTV, a normal scene for example could easily have luminance variations in one scene from

100,000 lux (very bright sunny spots) to 0.1 lux in dark shadow areas. In electronic range this ratio is expressed as 120 dB. This is far more than 60 dB, i.e. 3,000:1.

So, how does the camera compensate for this "lack" of dynamic range?

V. Damjanovski: Well, it manipulates the iris (both optical and electronic iris) to reduce the signal produced by a very strong incoming light, but by doing so the shadow areas in the same scene are getting darker. If you set the camera to open the iris and "see" more in the dark, then the very bright areas are overexposing the pixels and you have no details there. Either way, the narrow dynamic range is still an issue with solid state chips. In digital photography, perhaps, this problem is not so much visible, because a digital camera using a CCD chip only makes one shot at a time, and a photographer can change the exposure to make up for low light performance. In CCTV we have to produce 50 TV fields (25 TV frames) every second for PAL. So we are really locked down to one exposure speed of 1/50 second for so called "live streaming". This makes our CCTV imaging chips struggle more with the dynamic range than your digital photographic camera where almost any exposure is possible, albeit one at a time. So, what the Pixim design does is very unique. Their concept makes each CMOS pixel to be able to handle the electronic exposure individually. This means if there is a strong light projected by the lens in one area only of the imager (like for example car headlight or sun reflection from a window), the electronic exposure circuitry controlling each such pixel reacts to that information and shortens the exposure so that there is no saturation from the excessive light in the pixels. Each pixel has a meaningful information about the scene at that area. This refers both to the luminance values as well as chrominance. Where there are dark areas in the projected image, the pixels exposure goes to 1/50 second. This makes the apparent dynamic range become so much wider that almost matches human eye, which is, as I said earlier, around 120dB. Another very important circuitry implemented in this chip is the analogue to digital conversion of such pixel values immediately at the chip itself. This further reduces the noise from internal electronics. This is a great and very clever concept which makes such a CMOS imaging chip so extraordinary and much better than an average CMOS without such a design implementation.

Are all manufacturers using Pixim chip producing the same quality cameras?

V. Damjanovski: I have tested many models, and I don't want to sound negative, but the answer is definitely No. It is clear that camera electronic processing makes a lot of difference. It can improve the image, but it can also very easily destroy what is coming from the chip. Readers will know that there are many manufacturers that use the Pixim chip in their own cameras, perhaps putting the module in a box and adding a lens, but the Dallmeier's own camera Cam_inPIX design goes much much further with this chip. They add a lot to the already good concept of Pixim. First, they add their own electronic for further image processing and enhancement. Also, their product range includes a choice of analogue output cameras and IP cameras streaming either MPEG-2 or MPEG-4. Unlike other "IP cameras" this is a real time streaming camera that has picture no different than a highest quality analogue output camera, just in digital format. All models have extensive setup menu, but in order to minimise installer's fuss there is a number of presets which can be used in almost any scenario, the installer needs to just choose the application, indoor, outdoor, low light, etc. Furthermore, because Dallmeier is big in casinos, they have special presets made to suit the very difficult lights and colours in casino applications. It is interesting to see for example roulette wheel settings, black-jack, or similar. All parameters have been optimised for many variations of colours and light and one preset choice is enough, but this can be further modified by the user. Using Cam_inPIX in casinos is a quantum leap compared to previous CCD camera technology. Users can see and recognise not only cards and chips, but people in the same field of view. This has never been possible with any other camera before.

Is there any other features that you were impressed with during your testing?

V. Damjanovski: Dallmeier have thought of the setup procedure well too. If the installer or user doesn't want to play with the camera setting at the camera itself, using the external buttons, this can also be achieved from their front end PView application running on a PC, or by using a special little remote control setup, all done via the video cable, be that coax or twisted pair, without climbing ladders to reach the camera buttons. Recently, I witnessed the introduction of a complete new "designer style" cameras, the so-called DesignCams, to match an interior of an office, shopping mall, airport, casino and what not. The designer style case, for both full-body and dome cameras, are made to look like a very nice and polished mahogany wood, or perhaps marble, gold, silver, pearl or anything you can imagine. All made to the highest German manufacturing processes. May CCTV projects I have been involved in the CCTV industry has tough times with the architect or builders, who don't like the typical CCTV camera appearance and colours. They just simply don't match the interior design. With this simple idea of "designer style camera" Dallmeier have done another new and original thing, adding to the Pixim functional concept described previously a nice body finish.

More information on Cam_inPix:
www.caminpix.com

About Vlado Damjanovski

Vlado Damjanovski is an author, a lecturer and a CCTV expert, known to the Australian and international CCTV industry. He has a degree in Electronics from the University of "Kiril i Metodij" in Skopje (Macedonia), and has specialised in Television. His Thesis in 1982 was on CCD Cameras, 10 years before they started being widely used commercially. Vlado moved with his family to Australia in 1987, first working for TCN Channel 9, then joining the CCTV industry – he soon became one of the best-known CCTV experts in the CCTV industry.

Vlado Damjanovski and his company CCTV Labs are doing CCTV consultancy, system design, testing and training, both in Australia and overseas. He has designed and commissioned a number of CCTV Systems around Australia and overseas. He has also conducted a number of CCTV Seminars throughout the country and overseas, having over 10,000 technical people trained in many extensive seminars.

In 1995 his own company CCTV Labs published his book – simply called "CCTV" – one of the first and truly complete reference manuals on the subject of CCTV. This book is now accepted and approved by many international consultants and authorities as an exceptional reference book and many refer to it as "The CCTV Bible".

Some of the more interesting CCTV projects done by Vlado include Darling Harbour, Downing Centre Control, Sydney City, Qantas International Freight Terminal, etc. His biggest CCTV System design in Australia was done for the Star City Casino in 1997, pioneering the use of CCTV digital video recording technology where gaming disputes are sorted out immediately at the gaming tables. Another similar, first off design, is his involvement in 2003 in the first full digital matrix switching system design for the Sands Casino in Macau, consisting of over 1,200 MPEG-2 recorders and full video matrix switching over TCP/IP network.

Vlado has been actively involved in the past three years during the preparation of the new Australian CCTV standards AS 4806.1, 4806.2, 4806.3 and 4806.4, and was one of the main carriers of the shaping of the standard. He is currently the Chairman of the CCTV Standards Sub-committee, under EL 051 group.

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