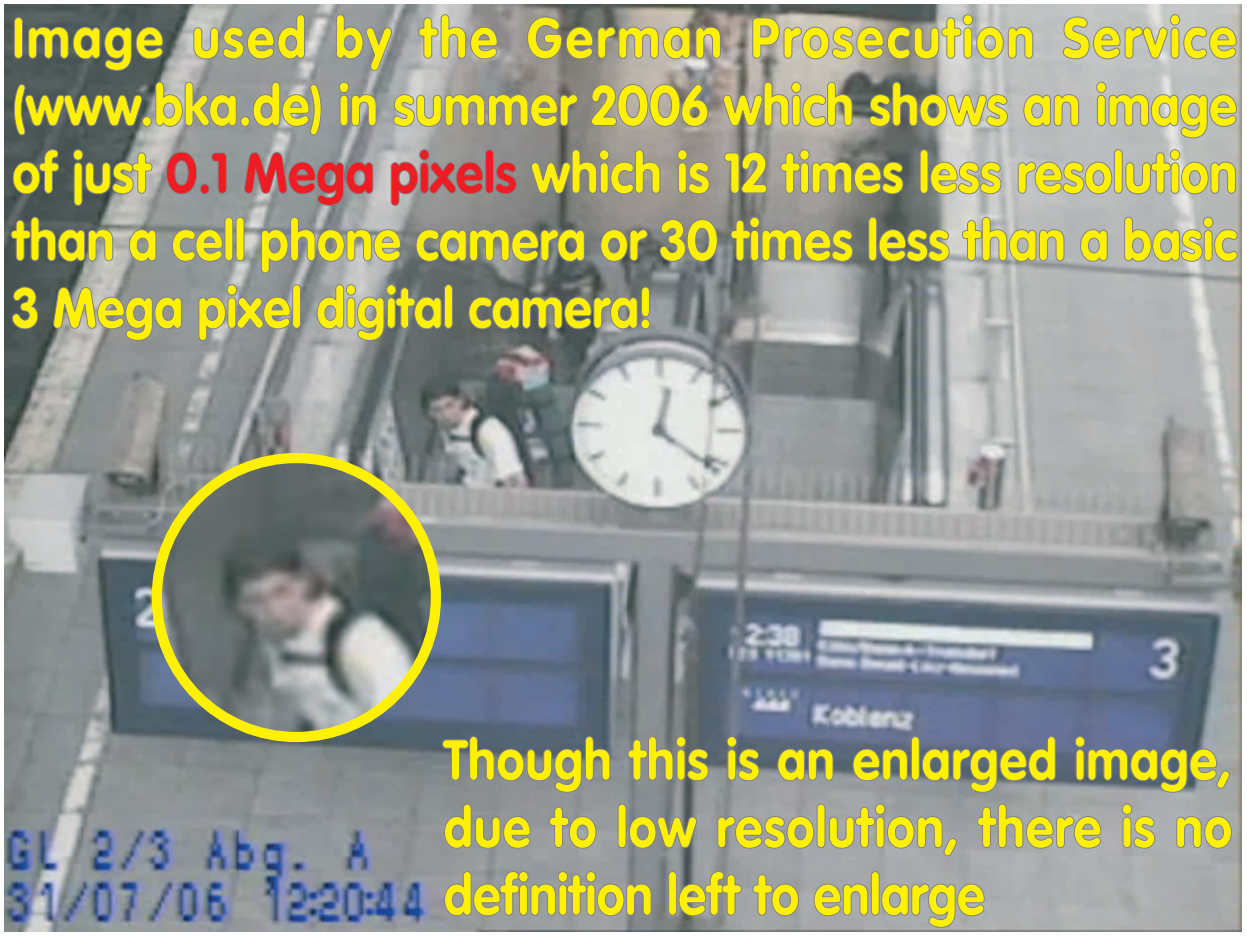
Technical Info 9/2006

Security-Vision-Systems

MOBOTIX AG

... the new face of IP video

Why does a common cell phone store images in better resolution than most public sector CCTV systems?



Even basic digital cameras provide more definition than the images from CCTV systems that are commonly used to identify terrorist. During the recent soccer World Cup Championships almost all the stadiums were protected by these outdated video surveillance cameras. Kaiserslautern alone decided to use some of the most advanced, high resolution digital surveillance systems now available. A simple comparison between the technology used in both systems clearly highlights the difference in image detail: even the simplest of digital cameras stores images of around 3 million pixels (3 Mega pixel), in comparison the "classic" video technology is restricted to 1/30 the pixels (101,000 pixels or 0.1 Mega pixel); even the most inexperienced amateur photographer would not buy such a low resolution camera these days. Despite these facts this kind of system is still being specified and deployed in up to 95% of public safety applications.

CIF Half Frames - A 50 Year Old Standard ...

50 Year Old Standard Blocks Innovative Technology

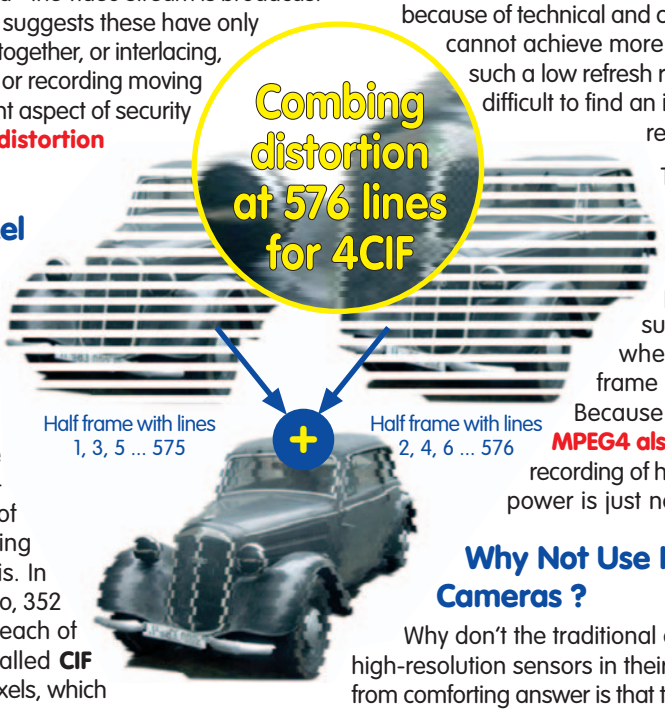
The poor quality of the images used in these public safety applications is not, as one would imagine, a result of the currently available technology, but rather the systems specified as the systems of choice, which are based on television technology more than 50 years old, using video cameras that deliver live images with a maximum of 0,4 Mega pixel. Due to technical and cost constraints of theses systems, the images are further reduced by a factor of 4:1 to just **0.1 Mega pixels**, making facial recognition almost impossible.

Why Not Store The Original Video?

So why do we not store the original image in 0.4 mega pixels? There are video systems that can store images at 0.4 Mega pixels, however, these are expensive and do not give the user sufficiently more detail. TV technology standard - the video stream is broadcast in "half frames", and as the name suggests these have only half the detail. The electronic fitting together, or interlacing, of these half frames when viewing or recording moving objects, which is the most important aspect of security surveillance, causes **combing distortion** (blurred edges) in the image.

Calculating 0,1 Mega Pixel For A CIF Image

The image delivered by a video camera has 576 lines made up of 2 half frames, each with 288 lines which are exposed consecutively one after the other and then transmitted. Because of the technical and financial considerations mentioned earlier, 95% of systems in use today are digitizing and storing on a half frame basis. In context with the width to height ratio, 352 horizontal pixels are digitized for each of the 288 lines resulting in a so called **CIF** image with 352 x 288 = 101,000 pixels, which is equivalent to 0,1 Mega pixel.



No improvement through use of 2CIF or 4CIF

The **2CIF** image format also uses only 288 lines but combines them with double the amount of pixels per line, giving us around 0,2 Mega pixel. Despite the increase in pixels per line, a considerable amount of important information is still missing from the image because every second line within each image is simply ignored, leaving us with what is accurately described as a half frame or half image. Made up of two interlaced consecutive half images, a **4CIF** format has indeed 704 x 576 = 0,4 Mega pixel but every second line is staggered or deferred because the half frames are exposed at different times. As a result of this so called combing effect, 4CIF recording is hardly ever used in actual systems. For example, at the World Cup stadiums only CIF, or in some cases 2CIF, half frames were recorded.

Snapshots Are Unreliable In Facial Recognition

An additional problem with existing video technology lies in the **low refresh rate of recorded images during playback**. Again, because of technical and cost factors, 95% of existing systems cannot achieve more than 1–3 frames per second. With such a low refresh rate of "snapshots", it becomes very difficult to find an image with enough detail for facial recognition.

This low playback rate is the result of one single computer having to digitalize and store video feed from multiple cameras. The computing power for full video is generally only sufficient for two cameras, therefore, when recording more cameras the frame rate has to be drastically reduced. Because of this limited processing power **MPEG4 also can not be implemented** for the recording of high resolution video, the processing power is just not available for multiple cameras.

Why Not Use Higher Resolution Video Cameras ?

Why don't the traditional camera manufacturers simply use high-resolution sensors in their video cameras? The clear, but far from comforting answer is that the standard the systems are based on for the transmission and recording of images is 50 years old and it is technically impossible for the video cable to process such high-resolution images. Understandably the video surveillance industry is reluctant to change, however, to protect the public, change is inevitable.

... MOBOTIX Is Twelve Times Better

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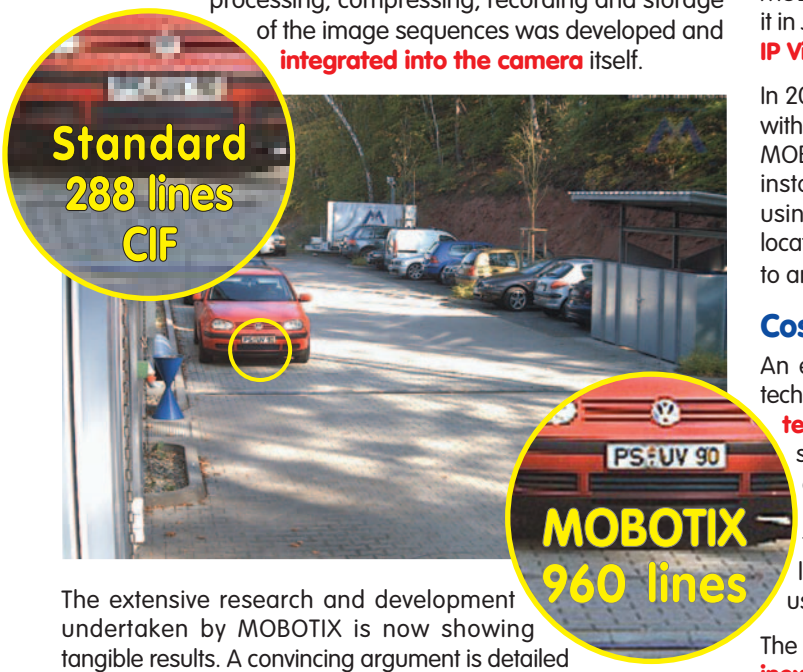
The Digital Difference: IP Cameras

New digital technologies also present opportunities for innovative newcomers like the Kaiserslautern-based German IP camera manufacturer MOBOTIX. Six years ago MOBOTIX started placing their emphasis on developing Mega pixel technology and transmitting video streams via modern computer networks, LAN, WAN, WLAN or over the Internet. In order to achieve this, a high performance processor with extensive software package for processing, compressing, recording and storage of the image sequences was developed and **integrated into the camera** itself.



The extensive research and development undertaken by MOBOTIX is now showing tangible results. A convincing argument is detailed in the above images which show an enlarged number plate from a stored 1.3 Mega pixel MOBOTIX camera, using 960 lines compared to a 0.1 Mega pixel image using 288 lines.

Remote Access During Recording

One of the great advantages of modern network camera technology is the ability to manage all configurations and to access live and stored images simultaneously while the camera is recording, remotely over the network, anytime, from **anywhere in the world**. These camera installations will be linked on the existing company network or even the Internet via a secured connection (VPN) and firewall.

In this way an incident or suspicious behavior in a train station, airport or any other public place can be immediately investigated by **retrieving the images to the control center via the network** without the necessity of having someone on site or having to stop the recording and live viewing. New or improved software for further functionality can simply be loaded into the camera through the network.

Continuing Advance of The New Technology

At the moment there are already over 100,000 MOBOTIX systems in use around the world, a figure that is continuing to rise on a daily basis. Some 50% of the systems that are currently being produced are exported and MOBOTIX cameras can be found not only in American embassies, airports in England, on dams in Japan and in post offices in Israel, but also along pipelines in Saudi Arabia and in parking garages in Mecca. After thoroughly testing a MOBOTIX camera, the British magazine, security installer, described it in June 2006 as **the camera that sets the new benchmark for IP Video**.

In 2004 a correctional institution (JVA) in Germany was equipped with MOBOTIX cameras, installed by the company Bosch. The 77 MOBOTIX cameras at the Kaiserslautern soccer stadium were installed by Siemens in 2006. The German Railway have been using MOBOTIX cameras in many different train stations and locations in a variety of applications ranging from passenger safety to announcing trains coming into the stations.

Cost Advantages Of The New Technology

An examination of the total costs shows that new MOBOTIX technology is actually **less expensive the current standard video technology**. By using 960 instead of conventional 288 lines, a stored image from a MOBOTIX camera has 12 times more detail which means, for example when watching turnstiles in a sports stadium, **less cameras** in total are needed to view the same amount of turnstiles. With a standard 90 degree lens it is now possible to view an entire room in more detail using only one camera.

The use of worldwide IT standards makes it possible to integrate **inexpensive system components**: whether over copper, glass or wireless via WLAN. **A power outlet is not necessary** as MOBOTIX cameras do not require heating to prevent misting and as a result can be supplied with power via the network cable all year round. That is why the 77 cameras installed in the World Cup stadium in Kaiserslautern have full functionality with only 500 Watts emergency power. The contemporary and innovative storage technique developed by MOBOTIX requires considerably **less storage PCs** for high resolution and streaming video. Internal buffering of the video within the camera protects the recorded images against power failures of a few minutes duration. The automatic regulation of frame rate based on motion detection further increases the storage capacity of the system. By avoiding the use of moving or mechanical parts (no auto iris necessary) MOBOTIX has become famous for the low maintenance requirements and **exceptionally high reliability** of the complete system. A weather-proof, high-resolution 1.3-Mega pixel camera (M22-Secure) is priced at EUR 798 to the end user, complete with software, audio, a super-wide-angle lens and mounting brackets. Specially designed high quality stainless steel vandal proof housings are also available.

High Resolution, High Reliability

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Original image from a MOBOTIX M22 (List price 798,-Euro Incl Lens and wall mount Camera)

A Direct Comparison Highlights The Difference

A comparison of a CIF image with 288 lines and a MOBOTIX camera image with 960 lines dramatically highlights the difference in quality and detail. Mega pixel imaging shows **12 times more** detailed resolution, so that a face taking up only 1/40th of the image width is still clearly recognizable. With the appropriate post editing the image quality can be further improved. In comparison, the image extracted from the CIF image is unrecognizable and therefore unusable.

Digital Is Not Always True Digital

In contrast to MOBOTIX, the majority of IP-Cameras, or network cameras are still using the old analog technology internally (**!**) and merely transmit a digitalized image via a computer network. Although it is hard to believe, most IP systems are only storing CIF half frames!

40 Fluid Video Streams On One PC

MOBOTIX established the **decentralized** recording process through the camera itself, enabling the simultaneous recording of around 40 **fluid** high resolution video streams on one single PC, which is the equivalent of **4,800 CIF-images per second** in the old technology. The commonly used **centralized** concept cannot, because of the limited PC processing power available, record multiple cameras in high resolution and have a maximum performance level of 100-200 CIF images per second in total for all cameras.

Abundance Of Storage

The storage of video from a MOBOTIX camera is done on an inexpensive standard IT storage device. A failsafe storage device (RAID) with 1.4 Terabyte is available for about 5,500 Euro. Such a device can store full Mega pixel resolution images at full frame rate including audio 24 hours a day from **one MOBOTIX camera for two months** or 10 MOBOTIX cameras for six days. These storage calculations can be dramatically increased by implementing MOBOTIX motion-activated frame rate control.

MPEG4 Is Not Suited To Live Cameras

The video standard MPEG4 was developed for compressing a **single** video stream (e.g. movie) and not for the compression, management and viewing of multiple high resolution cameras. MPEG4 transmits moving objects at lower resolution and quality because the human eye does not take in all the detail of a moving object, therefore, it makes no difference when watching a movie. For this very reason **MPEG4 is not suitable for security systems** because in a security situation, it is these moving objects that are of great importance and must be therefore highly detailed.

To handle the needs of security video, MOBOTIX developed the video standard **MxPEG**, requiring around only 2 Mbps for a high resolution video stream and exhibiting a shorter reaction time than MPEG4. The MxPEG standard is currently being implemented and supported by manufacturers and developers world wide and true to the MOBOTIX concept, it is license free and available to all.

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