

Seeing More with Improved Image Sensors

Image sensors boast more pixels, sensitivity and dynamic range today. They deliver real results for effective video surveillance.

BY LING-MEI WONG

Image sensors make or break video quality, making them a top priority in camera selection. With more suppliers, camera manufacturers have extra options.

The market experienced the recession firsthand. "Image sensor revenue across all surveillance cameras will decline from more than US\$700 million in 2008 to \$435 million in 2013," In-Stat said in a prepared statement.

Video surveillance cameras have little margin for error. Downtime could result in the loss of footage, thus requiring cameras to perform stably for long periods of

time.

A surveillance image sensor must be up for the task. "Security cameras need low-light performance, WDR and higher speeds than average consumer products," said Cliff Cheng, Senior Business Development and Marketing Manager, Aptina.

Security video requires quality over quantity for resolution. "Consumer products such as digital still cameras and mobile phones are heavily focused on increasing megapixels, while security applications require

the best possible low-light sensitivity and image quality," said Roy Karunakaran, Product Marketing Manager, OmniVision Technologies.

Cameras monitor constantly, helping human operators. "If the ultimate aim of a security camera is to replace a human observer at the scene, WDR is essential," said Clairpixel, a CMOS provider. "The human visual system is efficient at extracting information in extreme conditions. A camera must do the same or better."

Unique security requirements include low-light performance — surveillance imagers can be 30 times more sensitive than consumer ones. "Another is global electronic shutter, which removes the problem of rolling shutter artifacts," said John Monti, VP of Marketing and Business Development, Pixim. Fluorescent flicker reduction is also exclusive to security.

SHARP IMAGES

Image sensor improvements have resulted in higher-resolution video. "When selecting image sensors, we look for HD support at 720p or 1080p, as well as small data packet size," said Hong Yuan Chu, Engineer, Dali. The manufacturer deploys Sony CCDs in several cameras.

Sensor resolution affects manufacturer purchase

decisions. "As a manufacturer of network cameras, we rely on sensors that can support the highest quality resolution," said Daniel Cremins, Product Marketing Manager, Edge Devices, March Networks. "It's important to note that high video resolution affects more than just a camera or recorder specification."

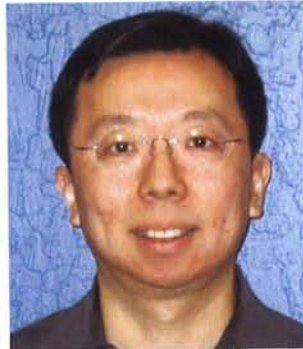
HD's large file sizes require efficient video compression for real-time transmission. "Effective compression for higher resolution, which is H.264, is essential," said Christine Lim, International Sales, iCanTek. The manufacturer deploys Pixim CMOS for several network cameras.

Capturing larger images makes video analytics easier. "Smart cameras are a small segment of the market, but Pixim sees them continuing to grow at faster rates than the overall camera market," Monti said. "The primary contribution an image sensor can make to an intelligent camera is to capture low-noise, color-accurate, WDR video with the fewest image artifacts."

Other image sensor providers corroborate a spike in edge devices. "We are seeing more new camera designs incorporating analytics," Cheng said. "Aptina is putting in features like statistic engines, WDR and context switching in our sensors, assisting intelligent algorithms to run more efficiently."



▲ Roy Karunakaran, Product Marketing Manager, OmniVision Technologies



▲ Cliff Cheng, Senior Business Development and Marketing Manager, Aptina



▲ Daniel Cremins, Product Marketing Manager, Edge Devices, March Networks



▲ John Monti, VP of Marketing and Business Development, Pixim

NETWORK VERSUS ANALOG

In general, traditional analog cameras use CCDs, while network cameras deploy CMOS.

Each technology offers unique benefits. "CCD sensors typically deliver high performance in low-light environments, while CMOS sensors are better at providing WDR," Cremins said. "However, advances are being made in both areas, and we constantly look to evaluate new technology as it becomes available."

The large pixel size of CCDs captures light better, but means fewer pixels can fit on a single sensor compared to CMOS, Cheng said. CMOS have lower power consumption, enabling PoE on network cameras.

A single CMOS chip fits in more features compared to a CCD one. "CMOS technology enables all the functionality of a complete camera to be integrated on a single chip, versus more expensive and bulkier multichip solutions used in CCD," Karunakaran said.

SENSITIVITY

Imager sensitivity depends on the application. "Outdoor applications require a camera with good low-light sensitivity to ensure the capture of

high-quality images regardless of the time of day or the weather," Cremins said. "Cameras with WDR are needed in sites with a combination of lighting sources, such as a campus building with large windows and significant natural sunlight."

An Aptina sensor enables sub-0.1 lux image performance, Cheng said.

The Pixim solution provides low-light and WDR performance, with 0.5-lux minimum illumination in color, Monti said.

CHIP SIZE

Imager sizes vary by application. Pixim estimated 1/3-inch sensors account for 90 percent of all cameras shipped, making it the de facto sensor format.

Aptina offers 1/3-inch sensors as well as other sizes. "For the low-end market, our 1/4-inch format VGA sensor supports dual output — digital and analog," Cheng said.

Smaller sensors use smaller pixels, hurting low-light performance. "For this reason, 1/4-inch image sensors have largely been relegated to consumer and DIY applications where the best low-light performance is not an application requirement," Monti said.

High-resolution cameras prefer imagers with bigger surfaces for more pixels. "For the 1/2-inch market, we supply multimegapixel sensors — 3-megapixel, 5-megapixel and 10-megapixel — which require high-resolution and electronic PTZ functions," Cheng said.

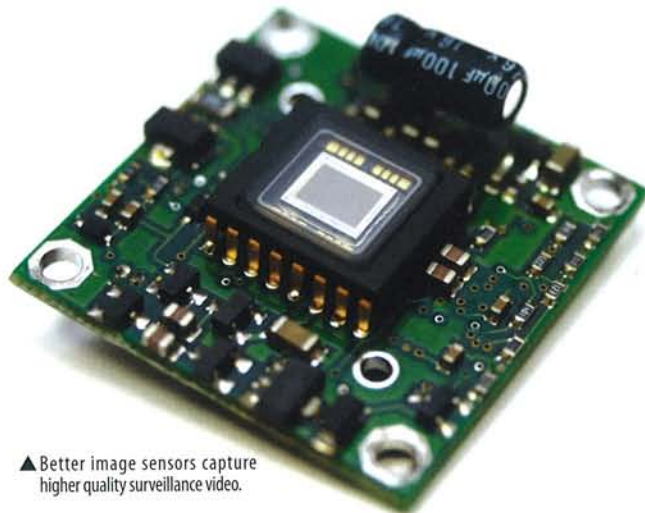
Larger sensors come at a cost, along with taking up more space. "All 1/2-inch image sensors used for video applications are niche products, as the lens infrastructure for the 1/2-inch format is limited, and so the lenses are expensive," Monti said. "Pixim estimates 1/2-inch image sensors have less than 1-percent share in the security market."

STANDARDS

The migration to IP enables greater connectivity, but true integration is still a long way off.

Standard compliance is considered for solutions. "We're monitoring the movement on standards, such as ONVIF and PSIA," Lim said.

Openness is becoming part of product design. "Although emerging IP standards from ONVIF and PSIA don't directly affect how we, as a manufacturer, select components, they are necessary to ease



▲ Better image sensors capture higher quality surveillance video.

integration challenges," Cremins said. "Manufacturers, integrators and customers alike can look forward to a time when the industry abides by one standard to ensure that any IP video edge device can work with any VMS or networked DVR system. This will also allow customers to mix and match best-in-class products from different manufacturers more easily."

Standards, however, do affect component integration. "Compliance with industry standards is becoming a requirement for security equipment suppliers," Monti said.

The HDcctv standard promises to upgrade analog devices to broadcast-compliant HD video at a lower cost than megapixel cameras. At the same time, ONVIF and PSIA are tackling one of the growth inhibitors of the network camera market — vendor interoperability.

ON THE HORIZON

A highly usable solution trumps a complex one, even if it has the latest bells and whistles. "Increasingly, organizations are demanding products that are quick and easy to install, which is forcing manufacturers to think more about the whole user experience when designing their products," Cremins said. "From camera mounting and positioning to loading software or updating firmware, you can expect technical specifications to reflect features that make system installation a more straightforward process."

Designing for ease of use will feature in component development. "The security market values easy-to-install, no-excuses, low-maintenance products," Monti said.

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