

Looking Inside Surveillance Camera and DVR Modules

Producing products from scratch requires significant R&D resources and time. Product manufacturers can increase their competitiveness with modules, lowering production costs and shortening time to market.

BY TRACY TING

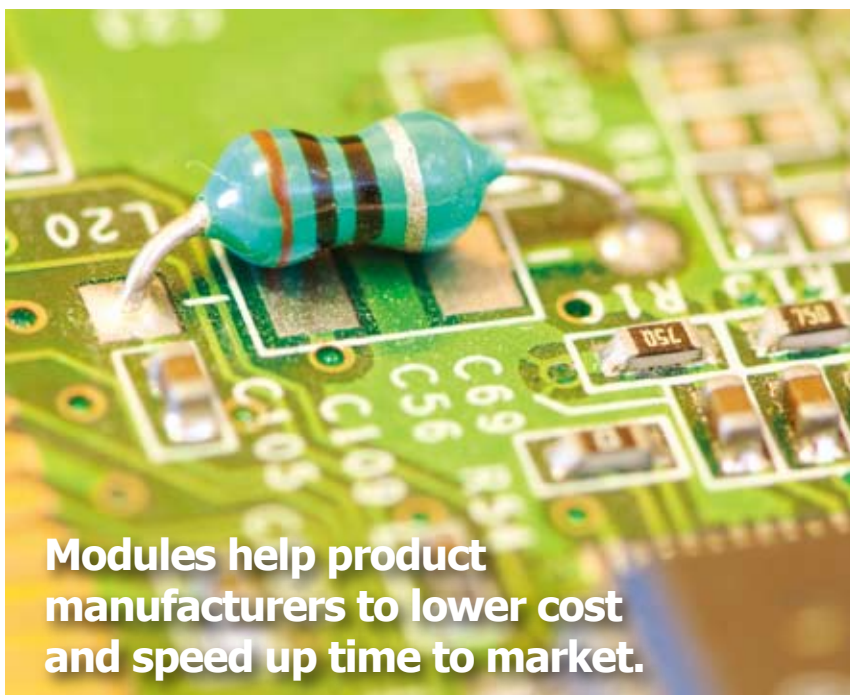
Board cameras and DVR boards are essential modules for video surveillance products. All components that a finished product requires are included, with software and firmware integration. Module manufacturers aim to build flexible and reliable product platforms. With open source codes and SDKs, these modules make customization easy for finished products.

CAMERAS

Strong camera know-how is a must for camera modules, enabling each component on the camera board works smoothly together.

Image tuning is required for modules designed with third-party image sensors. "Different cameras may use the same type of sensor, but it is the tuning that allows the cameras to function differently. The tuning of the camera module makes it capable of performing in different conditions, such as low-light, IR, megapixel or color cameras," said Upendra Patel, CTO at eInfochips. "A well-tuned camera can produce good image quality. However if a camera is not fine tuned, the final image will not be clear, no matter how good the processor and software are."

Image sensor selection is crucial. "Image sensors affect image quality. Choosing one from a good image sensor company is important, because



Modules help product manufacturers to lower cost and speed up time to market.

image tuning require significant know-how from the supplier," Patel said.

Tuning depends on the platform. "Tuning on a simple image sensor platform requires additional license fees for 2A algorithms and communication between the camera company, image sensor company and the semiconductor vendor," Patel said. "However, tuning on an image sensor with built-in ISP only requires communication with users."

Power and size are concerns when integrating components. "Most

camera designs are aimed at lower power consumption and size," said Patel. "Integrating all the features of a camera — including USB ports, Micro-SD cards, local display outputs, audio, PoE, auto iris controls on a board that is 100 by 44 millimeters — is a challenge."

ANALOG

Analog cameras still make up most of the market. "The electrical circuit of a quality camera module must be carefully designed," said Edwin Huang, VP of Technical Division

at Sunnic Technology. "Other than programming, the MCU allows auto LED light adjustments and dynamic video surveillance parameters. We also developed patented transcoders to enable IP integration."

PERIPHERALS

A quality board camera needs reliable power for a long life and low electrical impedance. "Power modules should have low output ripple noise. In low-light cameras, image noise reduction is linked to power modules and board design," said Henry Chung, Sales Director at E-On Optoelectronics. "Low-light cameras often turn up the automatic gain control (AGC) level for a clearer image. However, if there is noise in



▲ Upendra Patel, CTO at elnfochips



▲ Alan Peng, Director at Zero One Technology



▲ YoungHwa Oh, President at Chance-i

the image, turning up the AGC level will only increase the image noise."

The key to a power module is its aluminum electrolytic capacitor. "For this technology, we import high-quality components from Japanese companies," Chung said. "During the design phrase, our

module goes through testing in 60- to 70-degree Celsius environments."

EDGE DEVICES

Analytics adds value to cameras. Based on user requirements, analytics can be designed on the main camera board or a separate module. "With

ObjectVideo's analytic software library and TI's DSP, we developed an individual module to run powerful video analytics software," said Alan Peng, Director at Zero One Technology. "Each image frame is analyzed by a set of predefined rules. The algorithm is programmed to detect violations, such as trip wire. The minimum size for the detection of an onscreen object is 10 by 10 pixels."

To ensure added value, integration must be seamless. Thorough testing must take place to ensure the module complies with application-specific regulations and standards. "It is hard for camera companies to integrate a poorly made analytics module on their camera board," Peng said. "The module's interface must meet industrial standards, such as SPI/BT 656 for image formats. Everything should be open architecture with no proprietary designs."

Communication is key. "When customers wish to install analytic

modules on their cameras, their hardware, firmware and software engineering teams need to cooperate with our engineers," said Peng. "Our know-how on software and hardware integration is crucial to ensure the module's flexibility for different applications. We also provide technical specifications, application notes, knowledge and service to our customers."

A camera's networking components are often outsourced. They are mostly standard, such as Ethernet connection for TCP/IP and RTP/RTSP protocol for streaming. PoE and Wi-Fi are also available. "The stability of signal transmission is taken care of by the protocol and error resilience implemented in software," said Patel.

STAND-ALONE DVRS

The market for stand-alone DVRs is competitive. Finished product makers can optimize cost and differentiate products with new component

technologies.

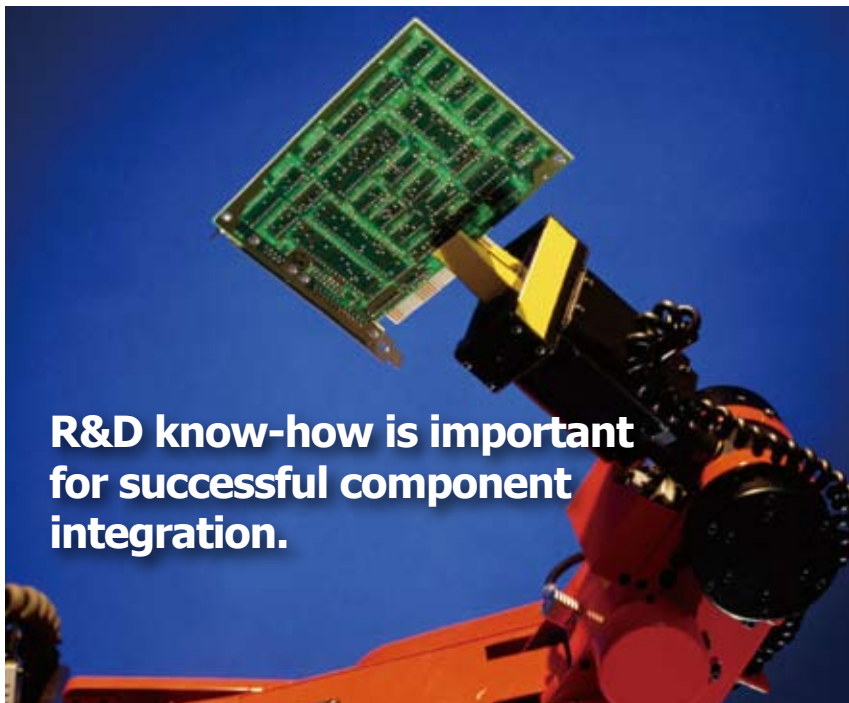
Quality components must be chosen. "For DSPs or SoCs, the selection criteria are the number of channels supported in the chip, power consumption and overall cost," said Patel. "Host processors must be able to have the capability to handle the network and storage management." The right processor depends on customer requirements. "The benefit of using DSPs is the scalability of design and reliability," Patel said. "The DSP provides room for image quality improvement in software and implementation of algorithms, like image stabilization, filtering and compression. The disadvantage is increased power consumption and cost compared to ASICs, which come with preprogrammed encoding engines from semiconductor vendors."

HYBRID SOLUTIONS

Hybrid DVR modules must support both analog and network camera inputs, requiring R&D know-how to switch between the two. "Our video compression is handled by a separate DSP, while network management and storage is handled by a separate processor. The decoding for network channels is handled by another DSP," said Patel. "This architecture provides flexibility when choosing the combination of network and analog signals."

"A high-end stand-alone DVR module should support up to 16 analog camera inputs at D1 resolution and four to 16 network camera inputs," Patel said. "Our module can simultaneously display up to 20 analog or network camera inputs on a local display."

The market trend toward hybrid DVRs means component suppliers



R&D know-how is important for successful component integration.

must support all network camera formats. "In the future, we expect that ONVIF and PSIA will make a difference in smoothing out this transition," Patel said.

PC-BASED DVRS

PC-based DVR boards require suppliers to write software and test the performance of components or chipsets before selection.

"Good PC-based DVR companies mostly came from IT backgrounds. To design a quality overall system, the R&D team must have IT know-how to enable seamless integration between the PC hardware and the surveillance software," said Young Hwa Oh, President at Chance-i.

Software is the main focus, but

some companies produce their own hardware for better integration and performance control. "With the powerful CPU and chipset calculations, our system processes images faster," Oh said.

BENEFITS AND CHALLENGES

PC-based DVRs install a capture card on a customized motherboard, enabling scalability and good system performance. "Users can view 32 channels by installing two 16-channel capture cards on their motherboards, without having to hook up two 16-channel DVRs," Oh said. "Access control and PoS can be integrated."

Inserting capture cards sounds convenient, but faces development challenges for system compatibility.

"The technology for motherboards changes quickly, as well as VGA display cards for surveillance," Oh said. "Sometimes a user's existing motherboard cannot support the DVR capture card."

OUTLOOK

Modules provide a cost-efficient solution. The development of modules will advance towards higher performance and lower prices.

"Big companies who wish to include the latest technology without losing their original R&D focus are sourcing modules from us," Patel said. "Smaller companies are also sourcing, who may not have the R&D resources to develop a finished product from scratch." 