EE Times:

Vendors race to pack cameras into cell phones

Junko Yoshida
EE Times
(09/08/2000 12:55 PM EDT)

PRINT THIS STORY
SEND AS EMAIL
REPRINTS
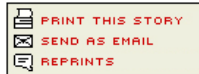
SAN MATEO, Calif. — Makers of CMOS imaging devices are racing to develop camera modules the size of a sugar cube for emerging design slots in cellular phones. The prize sought for the tiny cameras, which will pack a lens, sensor and processor, is a potential market of unprecedented scale for CMOS imagers.

"The portable/cell phone market is the Holy Grail," said Eric Fossum, chief technical officer at CMOS sensor vendor Photobit Corp. (Pasadena, Calif.). "It represents not only the highest potential volume but also a new opportunity that will not be fitted well by CCD charge-coupled device sensors."

Key industry players predict that by 2004, camera-enabled handsets will account for 20 percent to 50 percent of the global mobile phone market. Handset manufacturers and sensor companies are preparing for that day now by quietly conducting joint design and engineering projects. Some of those programs are near completion; others are still in the product definition phase. Early image-capture-enabled cell phones will roll from major OEMs over the next nine months; until then most of the collaborations are being kept under wraps.

STMicroelectronics, based in Grenoble, France, said it will ship its first-generation CMOS sensor camera module, code-named Matisse, next month to leading consumer electronics and mobile handset OEMs in Japan. Agilent Technologies Inc., a Hewlett-Packard Co. spin-off and one of the largest manufacturers of CMOS image sensors, claims to have completed CMOS camera designs and board-level implementations with a number of customers.

Other CMOS vendors aiming to enter the camera-enabled mobile phone market include South Korea's Hyundai, Japan's Toshiba and Sharp, and a Kodak-Motorola team.

Handset companies are treating imaging as a critical element for communications evolution, said Jason Hartlove, business unit manager for the imaging electronics division at Agilent. Both handset and sensor companies have far more than niche-market expectations for imaging phones.

And because of its power and size requirements, "this is a market where CCDs can't go," said Jean-Pierre Lusinchi, group vice president for consumer and microcontroller products and general manager of the Imaging and display division at STMicro.

That is not to say the market is a walk in the park for CMOS imagers. Engineers are wrestling with technical challenges that extend beyond those they've encountered in such established CMOS imaging applications as digital still cameras and camcorders.

Baseline requirements

Although design goals vary among OEMs, interviews with several leading CMOS sensor manufacturers revealed a common set of baseline requirements for a mobile phone camera module. The unit should be able to operate off a power supply of 2.7 volts or below and should consume well under 100 milliwatts of power. It should support both still and video imaging. Required resolution is full Common

Intermediate Format (CIF) or VGA. The complete package must measure less than a cubic centimeter and cost less than $10 for a solution comprising the sensor, optics, lens, mechanical housing and image-processing ASIC.

"A year ago, OEMs' demands were all over the map, but now they are finally coalescing," observed Prasan Pai, director of marketing for CMOS imaging solutions at Conexant Systems Inc. (Newport Beach, Calif.).

Most CMOS sensor manufacturers identified the form factor as the most important design requirement. "I've never seen a product in which the size is such a critical factor," said Philippe Geyres, corporate vice president and general manager of the consumer and microcontroller groups at STMicroelectronics.

Lusinchi said STMicro's Matisse module features CIF resolution, measures 1 x 1 x 0.75 cm, runs at 2.8 V and dissipates less than 50 mW.

Because mobile handsets must be thin as well as small, some handset companies also specify design requirements for a camera's thickness, or its "z-tolerance," said Conexant's Pai.

"Because you can't mount a flash in a handset, the sensitivity of a CMOS sensor is another significant issue," said Photobit's Fossum. At a given pixel size, a CCD has traditionally provided higher sensitivity than an equivalent CMOS sensor. But Fossum said the gap is closing: Sensitivity in both cases is on the order of 1 V/lux-second today for the same pixel size.

Another system-level issue is the module's vulnerability to electromagnetic interference, Fossum said. "Considering that the preferred area to integrate a camera is near the handset's antenna, extremely strong EMI is expected. This is a new challenge that we've never dealt with before, but with careful packaging, we think it is a manageable problem to solve."

Partitioning debates

Points of contention among OEMs center on partitioning of the image-processing function between the camera and handset and the I/O interface between the module and the phone.

The partitioning debate echoes one still being hashed out in the PC camera market. Under the so-called Intel approach, the camera module provides the raw data and a CPU handles image processing. The alternative envisions the camera's completing the necessary processing and providing 24-bit color images over a Universal Serial Bus.

"The debate over PC cameras is still continuing, and this is certainly an object of some debate among handset manufacturers," said Photobit's Fossum.

Where players stand on the issue depends on their expectations for the processing power that will be available in handset CPUs. "There is a very broad range of mobile phone architectures in the marketplace," noted Agilent's Hartlove. It's conceivable to do a bit of image processing in software using the infrastructure available in the handset, such as in an ARM core.

But Conexant's Pai warned that developers must take care with such a setup, since "the last thing handset manufacturers want is to see the network connection drop while the main baseband processor in the handset snaps pictures."

The I/O design between module and handset should take into account the available handset bus bandwidth, Agilent's Hartlove said. Typically, that bus speed is low — around 100 kbits/second — so "shipping around a lot of unprocessed imaging data inside the handset could take a long time," he explained. Under such circumstances, it may be wise to have the camera module handle all image processing, including compression, before the imaging data enters the handset.

Image quality, not surprisingly, is considered critical to the success of mobile phone-plus-camera products. Photobit's Fossum observed that most handset vendors are requiring CIF or VGA resolution. "There

aren't a lot of QCIF quarter CIF requirements out there," he said.

Ian Olsen, chief executive officer and president of CMOS sensor startup Y Media, concurred. "Resolution for cell phones today is 100,000 pixels or less," he said, "but we believe that for the imaging feature to be more than a curiosity, you must have VGA quality for still images. Y Media recently unveiled a 3-megapixel CMOS sensor for digital cameras.

"Consumers can't go backward," Olsen said. "Cameras incorporated in a mobile handset will eventually need to maintain image quality similar to or better than that of digital still cameras."

That's because handset vendors don't expect cell phone images to remain resident on the handset display. Images may move from the Web to a handset to another handset or to a PC display, TV or printer. "There is a lot of ambiguity on consumer behavior," Photobit's Fossum said; no one is yet sure how consumers will want to use camera-enabled phones.

But the bandwidth limitation within the network is real, and it's a serious problem. Even under the third-generation (3G) network infrastructure, it may not be practical to expect the 1.4 Mbit/s bandwidth required to send CIF-resolution, 30-frame/second MPEG-4-compressed video when a given cell is shared by a large number of users, according to Agilent's Hartlove. An alternative would be to use QCIF video images and compress them to 250 to 300 kbits/second — a manageable amount of data that can be shipped around the network.

Videoconferencing future

Although real-time video chat and conferencing applications are an eventual goal of such service providers as Japan's NTT Docomo, initial applications will likely be "still images and maybe video clips," predicted Steve Hsu, product line manager for embedded imaging at Conexant.

Meanwhile, network service providers are angling for creative ways around the bandwidth problems. They're hoping to profit by maximizing network use throughout the day, according to Hartlove. One idea is to design the camera phone in such a way that it can hold on to a picture until there is an opening in the available network bandwidth. The picture could then be sent to a server on the Web using non-peak bandwidth.

It may also be feasible to send a caller's picture via short message service. Instead of a list of names of your friends popping up in your handset when you want to make a call, their pictures would be displayed, Hartlove said.

Is that a practical application? Perhaps. As Fossum noted, "Many in the industry say that 14-year-old girls in Japan are the target audience" for the emerging mobile phone/camera market.

Analysts predict that consumer preferences will differ by geographical region. Alexis Gerard, president of market consultancy Future Image (San Mateo, Calif.), cited a recent survey by his company of 1,000 U.S. users of the Internet, 80 percent of whom said they owned digital cameras. When asked how important they considered the ability to wirelessly retrieve and display images on their cell phones, only 3.5 percent called the capability "extremely important." Thirty percent said it was "somewhat important"; the overwhelming majority said it was "not important at all."

But those results don't necessarily mean that consumers don't want the product, Gerard said. "Until they actually see a product, people really don't know what they want."

Cahners In-Stat Group is conservative in its growth projections for camera-enabled mobile phones. By 2003, when 1 billion cell phones are expected to be shipped, "I expect 17.8 million units to be camera-enabled," said Brian O'Rourke, senior analyst at In-Stat. That figure will jump to 59.5 million units in 2004, according to his prediction.

Growth of the market depends in part on how fast the 3G infrastructure falls into place and how soon low-cost high-quality color displays — LCDs or organic LEDs — become available for cell phones, O'Rourke said. And while In-Stat's growth projections are

conservative, the company believes cell phones are a significant market for CMOS sensor manufacturers.

To put the projected totals in perspective, O'Rourke noted that only 15 million camcorders were shipped worldwide during 1999.

PRINT THIS STORY
SEND AS EMAIL
REPRINTS

Please login or register here to post a comment

Free Subscription to EE Times

First Name		Last Name	
Company Name		Title	
Email address		CONTINUE →	

Electronics Marketplace

Astec Power- World Leader in AC-DC and DC-DC Power
Download free catalogs and use Astec's Power Wizard to locate the power solution you need. Standard...

1.2 Million Data Sheets on ICs, Semis, Passives
Search & compare over 100 million parts, download data sheets, buy from franchised distributors.

New Agilent Acqiris Digitizer, 2 ch, 1-2 GS/s,<15W
Extremely low-power consumption, high throughput digitizer with 1 GHz analog bandwidth.

Make cross-country meetings without travel.
Meet over the web. It's easy to share desktops and deliver presentations with WebEx. Try it free no...

Free IT WP: Browse Productivity Papers
Thousands of IT papers. Browse through productivity topics of interest and be a well informed buyer

Advertise With Us