Display module selection for Web-enabled medical devices

TFT LCDs with Web-standard resolution enable devices to support future upgradeable equipment platforms

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Medical electronics continues to embrace personal computer technology along with enterprise networking and databases. This effort aids caregivers in the management of patient data and enables information to flow from the point of acquisition to the diagnostic specialist to the examining physician quickly and efficiently.

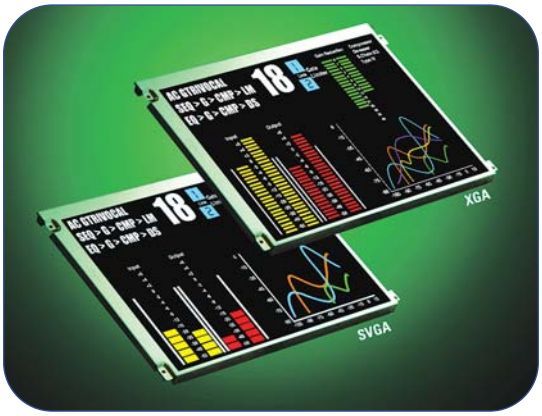
Many medical devices are already equipped with networking capability, allowing for applications such as the centralized monitoring of patients, or the sending of images from an x-ray technician to a radiologist. The display design engineer is faced with special requirements.

Key factors in choosing the right display for networked diagnostic and medical devices are resolution, front-of-screen performance, longevity, portability, durability, and EMI suppression. The most popular displays used in medical devices today are 10.4-in. VGA (640 x 480-pixel) flat-panel LCDs, while many newer medical workstations are using XGA (1,024 x 768) or SXGA (1,280 x 1,024) monitors.

The higher-resolution screens will enable greater functionality in existing devices by providing more-detailed information and/or multiple aspects of the device's operation. The use of Web-type design tools allows for automatic scaling of the image based on the available resolution, providing a functional migration path upward for existing user interface designs.

CRT versus LCD

In general, static images will look better on a TFT LCD than on a CRT, and rapidly moving images will look somewhat better on a CRT than on an LCD, but that advantage is not as strong for computer-generated content as it is for camera-generated content. If the camera content is relatively slow moving, like most medical images, there is virtually no discernable difference.



These XGA TFT LCDs suit Internet-enabled medical devices with high on-screen content.

Resolution is not the only compelling feature of color TFT LCDs over CRTs. The front-of-screen performance of modern color TFT LCDs is hard to beat. With contrast ratios up to 500:1, luminance of over 350 nits, color saturation over 70% of NTSC, and response times less than 40 ms, the visual performance is greater than that of CRTs by a wide margin.

CRTs struggle to achieve over 100:1 contrast and over 130 nits of luminance. Color saturation and response times have traditionally been the strong suits of CRTs, but recent color TFT LCDs are now equal to the CRT for color, and just a little behind in response time (and *that* is steadily improving with techniques such as Feed Forward Driving).

Of course, a major benefit to incorporating a TFT display is in the area of thinness and portability. TFT LCDs are lightweight, with a 12.1-in.-diagonal display weighing just over 1.5 lb (0.680 kg).

LCDs have very small borders, allowing the industrial designers to create sleek bezels and compelling form factors. The thickness of a TFT display is typically 1/2-in. or less, which means the overall depth of the product it is used in to be reduced.

Displays for Web-enabled medical devices

The advantages of color flat-panel displays, specifically TFT LCDs, are especially significant for networked diagnostic and monitoring devices. Designing medical devices is truly a multidisciplinary exercise, combining industrial and product design, software, human factors, man-machine interfaces, power supplies, digital and analog circuits, and radiated and conducted emissions, not to mention the actual medical function.

As we worry about all of the things happening inside the device, we must still consider how the device is actually being used. In addition to making the device easy to use for the operator, the man-machine interface should also give the patient a sense of confidence.

From personal experience, I know that I become uncomfortable seeing a doctor or nurse struggling to use a "new" piece of equipment that has just arrived, hearing complaints that it doesn't work like the "old" one, and so forth. It is easy to see that product configurations vary from manufacturer to manufacturer, and that it is not always obvious how to use the device.

XGA resolution

The Internet has evolved to allow webmasters to design completely

In the fast-moving medical field, TFT XGA LCDs (such as the 15-in. diagonal Optrex panel shown on right) provide more pixel resolution to existing devices for greater functionality across various testing modalities than do the traditionally used CRTs shown in the photo from the operating room (left).

unique sites that most people can navigate with ease due to common navigation metaphors. Most Web designers expect that their visitors are using a standard browser featuring a minimum resolution (some sites are resolution independent, but still have an expectation of a minimum resolution), and increasingly, this resolution is 1,024 x 768 pixels.

Bringing XGA resolution to medical devices and establishing a consistent interface metaphor create several possibilities. These include less time required for training and more accurate usage due to familiarity with the interface.

In addition, information created on one device can be displayed on other devices without having to create any special software. Also, using the same minimum resolution on the diagnostic or monitoring device display as well as the doctor's computer screen can improve the consistent presentation of images.

Another advantage is that medical professionals can receive their training on the device that they are using, and that training can also be made available online without having to make any changes, reducing training costs for both the medical professional and the device manufacturer.

System advantages

The advantages of Web-enabled flat-panel high-resolution displays in medical devices go beyond enhanced functionality, easier implementation, and reduced training costs. They also include the ability to enable remote access directly from the device, and the capability to moveå to platform products with enhanced value proposition due to future upgradeability.

Performance advantages of color TFT LCD flat-panel displays include low power consumption, light weight, durability, front-of-screen performance, and low emissions. With field-replaceable backlights, LCDs can be returned to original performance levels even after years of use, reinforcing the benefits of future functional upgrades to the base platform. The combination of color TFT LCDs with networked, Web-enabled devices results in a compelling platform for the relentless pursuit of improving patient care. EP

The medical Internet kiosk

Since many medical devices are already equipped with networking capability, moving to a platform concept where techniques and features of the Web are incorporated into medical devices using displays with XGA resolution essentially creates another kind of Internet kiosk. This kiosk could be used in several ways:

- Remote use of medical devices. While remote use of medical devices is not new, and telemedicine has been around for more than 10 years, many of the products are based around the use of a personal computer-more hardware/software to buy and maintain. Moving this functionality to the medical device results in a simpler deployment, allowing the small, rural clinics to offer more services, in spite of not having specialists on staff in every area. The same devices used in big-city hospitals can be used in rural clinics, improving consistency of patient care.
- Home use of medical devices. With the trend toward more home care, and the trend toward Internet access in the home, it would be possible to combine these features into a virtual house call. The patient would be instructed, via the device, on its proper operation and the results would be sent directly to the physician. Again, the Web navigation metaphor allows the patient to operate the device without specialized training. The medical professional is able to see the results immediately. This is basically an expansion on the approach taken by cardiologists, for example, to monitor pacemaker functionality via dialup modem.
- Medical staff education. Web-based training is available from major medical device manufacturers on the use of their equipment, but is based on using a personal computer, not the device itself. Moving this capability to the device will help facilitate the deployment of new equipment, as well as speed the training of new staff.
- Calibration, maintenance, and repair. Maintenance professionals could access schematics, upgrades, patches, and so on directly from the device, improving efficiency.
- Multifunction devices. The emergence of new devices that monitor all vital signs, while providing waveforms and alarms, has paved the way for more functionality in a single device. Turning to a common-interface architecture will allow the medical professional to utilize additional functionality while minimizing additional hours needed for training.