WHITE PAPER

Texas Instruments

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The Future of Digital Video

Introduction

Exciting new applications become possible when video becomes part of products, which in the past, have been unable to incorporate video systems. The applications for video go far beyond mere playback of existing content. With advanced processing technology, not only is a higher quality user experience possible, so is a whole new range of innovative applications where the device itself is able to intelligently use video to improve quality of service, operating reliability and user safety. Consider a whole new world enabled by digital video technology.

Digital Enrichment for the Home

Intelligent set-top boxes will bring new levels of functionality to the home entertainment experience. Set-top boxes will stream programming from anywhere in the world to enable true video on demand, whether the programming is stored on a home computer or occurring live. Set-top boxes will also integrate home surveillance security systems into the heart of the home entertainment center to enable viewers to identify visitors at the front door visually on their TV screens without having to leave the couch. Through object/facial recognition technology, the security system will be able to automatically identify family members and let them in without a key. We will have our entertainment anywhere and at any time we want it.

Set-top boxes will automatically set their own clocks, making recording programs as simple as a single button push. And with voice recognition technology, users will be able to adjust the volume or change channels by voice command without having to hunt for an elusive remote-control. By taking advantage of integrated functionality, engineers will be able to consolidate design and offer a complete home entertainment system requiring less equipment that lowers system size, cost and power consumption.

New features and services will be enabled as well. Service providers offering triple-play service (voice, video and data) will be able to offer integrated videoconferencing to support real-time video calling. Through on-demand detailed content services, users will be able to access detailed information, such as stats for an athlete, more information on the topic covered during a show or extended product information, such as details for a newly released car while they are watching a program. Remote access services make all this information available on portable devices while away from home. For example, a fan would have access to the same rich database of player information on his or her PDA while attending a live game as is available in the living room.

Digital video also disrupts the current expectations of electronic gaming. Virtual gaming with video projected on the user's regular eyeglasses affords innovative and unique entertainment experiences by immersing users into an experience in which they can see themselves as a character "physically" interacting in a virtual world. Near-ubiquitous network connectivity allows players to interact in real time with other players around the world. Wireless technology will free gamers to play anywhere, and object recognition technology will ensure that they don't bump into anything while they do so.

More Quality and Control to Consumers

Photography and video camera equipment will provide even higher levels of quality while further simplifying how users interact with their pictures and video. Advances in silicon manufacturing process technology and computational algorithms will increase overall video and imaging quality. Advanced pre- and post-processing algorithms will intelligently adjust lighting, contrast and focus to ensure that every picture is picture perfect.

Enhancements, such as depth of field processing, will significantly increase the real-life quality of images. Flexible processing options will enable users to capture images using a variety of settings, including black/white, color, infrared, heat sensor and others. Intelligent photo management will enable fast and easy retrieval of photos, as well as automate management of them, through object recognition at the time photos are taken. With intelligent cameras, a myriad of new features are possible. For example, consider a camera that will take a photo only when everyone in the picture has his or her eyes open. Finally, we will have pictures of what we saw rather than want the camera lens saw.

Improved Safety and Health Management

In addition to improved entertainment features with digital video innovations, automotive applications will increase system reliability and driver safety through advanced car windshield projection technology. Overlays projected directly onto the windshield will convey important information, such as the current speed, so that drivers can direct more of their attention to the road ahead. Object recognition technology will outline incoming objects when driving through fog so that drivers can see as clearly as if there were no fog at all. With nighttime vision and heat-sensing technology, drivers will be made aware of objects beyond the range of their headlights or off on either side so that an animal or object will not suddenly appear in front of or between vehicles. Together, these features will enable the intelligent car to identify potential risks and proactively alert drivers to reduce the number of accidents and increase overall driver safety.

From a health management perspective, new medical equipment will enable doctors to have greater visibility into the human body, as well as provide on-the-spot diagnostic capabilities, resulting in more efficient and effective medical care to save more lives. Pocket medical imaging devices will provide high-definition, real-time body scanning. With such devices, emergency personnel will be able to initiate better patient diagnosis by scanning information that is immediately and automatically sent to the hospital in real-time so that proper treatment can be administered en route, saving precious minutes.

At the hospital, doctors and nurses will have wireless, intelligent monitoring devices. Digestible cameras no larger than a vitamin will provide detailed information to doctors as they travel through the body. Diagnosis accuracy will be significantly improved by the use of portable e-clipboards that travel with the patient and make a patient's entire medical history, status, current medicine intake and other important information immediately available to any hospital personnel.

The Foundation for Innovation

To be able to bring these new visions of digital video to reality, it is necessary to reduce the complexity in video processing systems. Digital video systems themselves are extremely complex systems, especially when they are only one part of a more complex application, such as medical instrumentation or a motor vehicle. Today, many digital video applications are not as effective or compelling as they could be because of low-resolution video (especially in portable applications), lack of interoperability with other video equipment and required PC-based support for many devices.

The key enabler is an architecture that supports extensive design flexibility and programmability, yet delivers a quality video experience at acceptable system cost and often portable size. In this way, developers can quickly support new multimedia standards and implement enhanced functionality to remain competitive and deliver efficient solutions to meet many consumer and industrial end equipment price/performance targets.

The greatest gains, however, are made when this same flexibility is extended to the system-level. Many application-specific capabilities, such as reliable transport of video over IP networks, are costly to implement and usually limited to only a few companies. The availability of off-the-shelf code, from low-level codecs to application-level network stacks, as well as their integration at the system level, eliminates a primary source of design complexity.

The adoption of efficient standardized codecs (such as Windows Media®, H.264, MPEG-2, etc.) will advance the capacity of embedded applications to incorporate and stream video. With a programmable platform, not only can developers select best-in-class codecs, they can also support a wide variety of codecs without having to make any changes to code at the application level. Developers are able to scale across product lines to maximize IP reuse, reduce overall time-to-market and simplify cost-reduction through optimized silicon, all without substantial redesign.

Value-Added Focus

A critical factor for using digital video in a system is for the system designer to be able to use the technology without having to create it.

A medical instrument OEM, for example, has invested in understanding the human body, ways to measure its status and efficient mechanisms for evaluating these measurements. It is this investment and expertise, rather than their expertise in JPEG codecs that enables the OEM to create value in its products. It does this by building its value-added services on top of base electronics technology.

Typically, OEMs do not have expertise in how to implement digital video and any ramping up required directly translates into delayed time-to-market and diverted development resources. Ideally, these developers should be able to treat video as just another system-level component, integrating it into the system with relative ease similar to the way they already leverage off-the-shelf processor, memory and display technologies. They want to focus on using the technology to enhance the value of their own expertise rather than creating it.

The DaVinci™ Effect

TI's goal is to create flexible technology that enable OEMs to innovate with to make their vision of the future a reality today. Where TI's expertise comes into play is at the technology level. By understanding the needs of developers, TI has been able to develop the critical silicon, development tools and software necessary to enable innovation.

With DaVinci technology, TI raises digital video product development to a whole new level. The highest performance DSP cores, ARM® processors, video accelerators and advanced video and networking peripherals will be combined into optimized DSP-based, systems-on-chip (SoCs) to deliver programmable, optimized video system performance at minimum system cost. Developers will benefit from architectural innovations at the silicon level, but because they will use software that takes advantage of these innovations instead of having to create that software themselves, so their design cycle is reduced from months to weeks.

To tap the power of these platforms with minimum development effort, development platforms and reference designs based on DaVinci technology extend this value by providing the code developers require to implement video at a functional level. TI and its third parties will offer system-level application code, from software that handles video transport to complete video-over-IP network turnkey systems. This will enable OEMs to efficiently implement digital video without bogging their developers down in codec, transport or standard implementation details.

Developers no longer need to be a DSP expert to use a DSP. No longer will developers need to spend weeks or months optimizing DSP code; TI and its third parties have already done this through off-the-shelf, optimized, production-ready codecs and application code. Developers will be able to treat DSP as a resource, and not be required to write a line of DSP code unless they want to for their specific application. As a result, OEMs will be able to focus on their value-added features to bring significant value to their customers, bringing them to market faster with more competitive products.

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