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VIGRA SLIVER™

A Cost Effective Solution for Demanding

Military, Medical, Industrial and Communications Applications

Overview

In recent years, the requirements of users across a wide range of industries and government operations have dramatically increased the need for applications that can smoothly integrate real-time video and audio information with computer based graphics and database-resident information.

In order to meet the requirements for such real-time multimedia data integration in high performance systems, designers have traditionally been faced with a struggle to combine separate graphics/video and audio processing components, to integrate them with the system's primary CPU and operating system, and to interface them with the appropriate compression and communications standards. Throughout this integration process, designers must balance the processing tradeoffs between the CPU and the graphics system sub-components - a delicate balance which can significantly impact overall system performance.

Some of the key problems system designers currently face when integrating separate components include:

- The high cost of using separate sub-system processor cards
- Wasted overall investment from unnecessarily redundant circuitry on separate cards
- The diversion of scarce development resources to deal with inter-processor integration
- Maintenance and support difficulties between separate suppliers of individual sub-systems
- System overhead on the part of the primary CPU to control and coordinate the separate sub-systems
- Lack of uniform adherence to standards by the various separate sub-system suppliers
- Lack of overall design flexibility and extensibility as system requirements evolve and change

The Vigra Sliver Solution - Responding to Market Requirements

Military requirements such as Command, Control, Communications and Intelligence (C3I) have spurred requirements for real-time monitoring and analysis of remotely-collected video/audio information. Aerospace and undersea telemetry applications are also demanding that monitoring systems be able to handle, display and integrate more and varied types of data inputs, including audio and video streams. Medical applications are making increased use of computerized analysis and decision support systems for handling visual/audio data such as X-rays, CAT Scans and real-time patient monitoring information. Industrial applications requiring computerized integration of video/audio information span a range including high-resolution video inspection systems, process control applications, and security monitoring. High performance video/audio applications are also needed throughout the communications industry to support such emerging trends as collaborative computing, the Internet/intranet usage of "video-as-browsable-information", and for the centralized management of future consumer-oriented video-on-demand type services.

As a leading designer of graphics, video and audio processing sub-systems for high performance market requirements, VisiCom has responded to these evolving market requirements with the announcement of its new Vigra Sliver™, a highly configurable, VMEbus, single-slot, standards-based solution to meet the needs of high-end system designers. Sliver is an extension of the Vigra family of video, audio and graphics board solutions available from VisiCom for the Sbus, VME and PCI markets.

The first Vigra Sliver board was developed in response to specific market requirements for high performance multimedia systems. These market requirements include:

- Capability for real-time integration of video and/or audio streams with graphic overlays and/or text

information.

- Enough built-in processing capability to effectively off load the system's primary CPU
- A range of resolutions up to 1280 x 1024 and frame buffer depths up to 8-bit
- Capability to simultaneously handle multiple video streams in separate windows
- Options for double buffering
- Built-in support for compression standards (such as MPEG, JPEG, H.261, etc.) through optional daughter cards
- Built-in X Windows emulation to ease development and migration of applications
- Design modularity to allow tight control of overall system cost without sacrificing the smooth integration of functionality

By incorporating all of these requirements in a single VME 6U size plug in board, the Vigra Sliver multimedia server gives systems designers a uniquely extensible platform that adapts to their needs rather than the other way around.

Why VME?

The VMEbus is a prime candidate for implementing high performance multimedia systems because it is both rigorously defined and widely supported. VMEbus system building blocks are already available to support a wide variety of system configurations and feature sets. VMEbus gives the system designer many choices between chassis, backplanes, CPUs and operating systems while at the same time providing a tightly defined standard within which to integrate the chosen components.

First introduced by Motorola in 1981, VMEbus became an adopted standard, IEEE-1014, in 1987. The VMEbus Industry Trade Association (VITA) subsequently assumed control of the standard and has enhanced it with additional features that enabled 64-bit block transfers and improved performance, configuration management, and mechanical robustness. In May 1995, the resulting VME/64 bus was recognized by the American National Standards Institute as ANSI/VITA 1-1994. This expansion of VME bus flexibility and performance, along with its historic industry-wide acceptance, has set the stage for making VME the implementation platform of choice the multimedia systems.

Some of the major advantages of VMEbus systems include:

- The ability to use multiple-master CPU configurations to boost performance and processing bandwidth.
- High system bus bandwidth
- Mechanically rugged circuit board and chassis formats (based on the IEC 297 Eurocard standard) and that use reliable pin-and-socket connectors.

The most popular format for VMEbus boards is called 6U and measures roughly 6" by 9" in area. VisiCom chose the 6U standard as the form factor for its Sliver motherboard because of 6U's ruggedness and its wide acceptance as a standard for military, medical, industrial and communications platforms. While market forces make the VMEbus a clear choice for first implementation of Sliver, its basic system architecture is designed to be platform independent. Because the 32-bit on-board system bus is separate from the VMEbus interface, the overall Sliver architecture can be readily adapted for future use with systems based on other buses, as new market requirements develop.

The Sliver Architecture

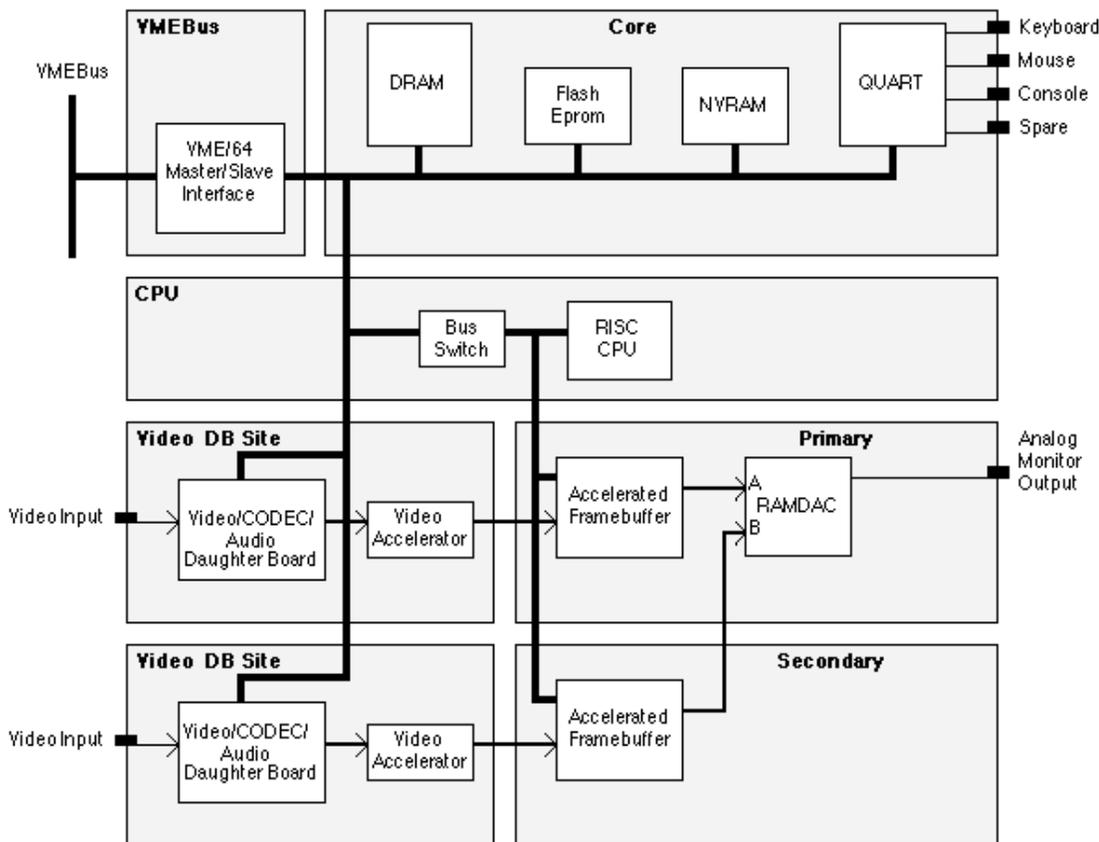
Sliver is modular in design so that it may be configured to meet specific requirements. It is designed around several high performance, highly integrated components working together to implement a very powerful and cost effective multimedia server. The core RISC processor handles all communication and control. The VMEbus master interface controller decouples the Sliver system bus from the VMEbus to speed throughput. Two graphics accelerators provide very high speed 8 bit per pixel rendering into two orthogonal frame buffers. Two video accelerators support smooth scaling (shrink and enlarge) of full frame rate full resolution video windows.

Optional video capture daughter boards provide real-time video input. The product architecture also provides for optional daughter cards to provide modularly integrated functions such as: frame grabbing; digitizing; image compression (JPEG); image decompression (MPEG, JPEG, H.261); digital audio; displaying of still and live video in a window.

As can be seen in the following system diagram, the Sliver architecture provides a VME/64 compatible interface from the VMEbus to the local 32-bit system bus, an on-board 32-bit RISC processor, 8 to 32 Megabytes of DRAM, 128 Kbytes of FLASH EPROM, a 4 Channel UART which provides interfaces for a keyboard and mouse plus two RS232 serial ports. Two separate accelerated graphics frame buffers each provide 2.5 Mbytes of Video RAM with dedicated video accelerators. In addition, two available sites for optional daughter boards each include a full system bus interface and video accelerator interface.

Sliver's combination of a high performance motherboard with a variety of optional daughter boards gives system designers maximum configurability. Designers are able to mix and match Sliver's modular components to achieve the optimum balance of cost, features and performance. The high performance Sliver motherboard, starting at \$5,900 in single quantities, provides a low-cost core for a wide range of multimedia systems. As optional daughter boards are included, designers can create custom-tailored multimedia systems with built-in features such as video capture, audio and video compression, etc.

Sliver Architecture



Sliver's On-Board X-Server Off Loads the System's CPU

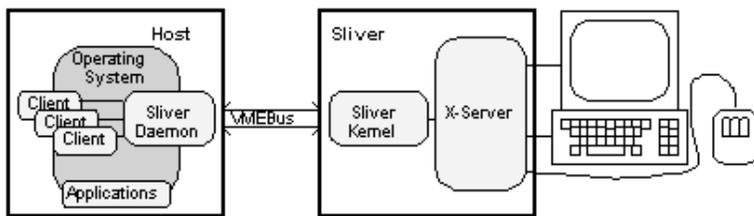
In order to satisfy the system designers' needs for an effective and flexible mechanism to off load the primary CPU,

VisiCom included full support for the X Windows server on the Sliver motherboard. The server, which is X11R6 based, turns Sliver into a complete, high performance VME/64-based X-Terminal. As a result, Sliver can be integrated directly into any system in much the same way as a remote X-Terminal; however it can communicate at high VMEbus speeds rather than much slower LAN speeds. This gives the designer a standards-based, easy to integrate method for off loading the CPU that delivers maximum performance.

Because the complete X-server is included on the Sliver board, communications are held to an effective minimum between the system CPU and the Sliver board. Some other board level VME graphics solutions merely use an on-board graphics frame buffer that is driven by X-server software running on the system's CPU. These implementations pose the dual problems of placing extra processing demands on the system CPU and potentially overloading the VMEbus with raw graphics information rather than high level X commands. While the addition of a high speed graphics rendering engine to the board can produce impressive graphics benchmarks, it still falls short on overall system performance because of its failure to effectively off load the system CPU.

Sliver gives the system designer an optimum, real-world solution by essentially providing a full-featured, board-level, X-Terminal that effectively off-loads the main system CPU while communicating with it at high speed VMEbus data rates.

Sliver Implementation of the X-window System



The Vigra Sliver X-server also provides maximum platform independence through the use of a small host-resident daemon that provides the server interface. The Sliver daemon, consisting of only a few hundred lines of code compared to several hundred thousand lines in the X-server itself, allows Sliver to provide consistent support across multiple operating systems.

Because the X-Windows system is widely used by military, medical and industrial applications for graphics and video display, it provides a natural base for both migrating existing applications and developing new ones for systems using the Sliver multimedia server.

Market Applications for Sliver

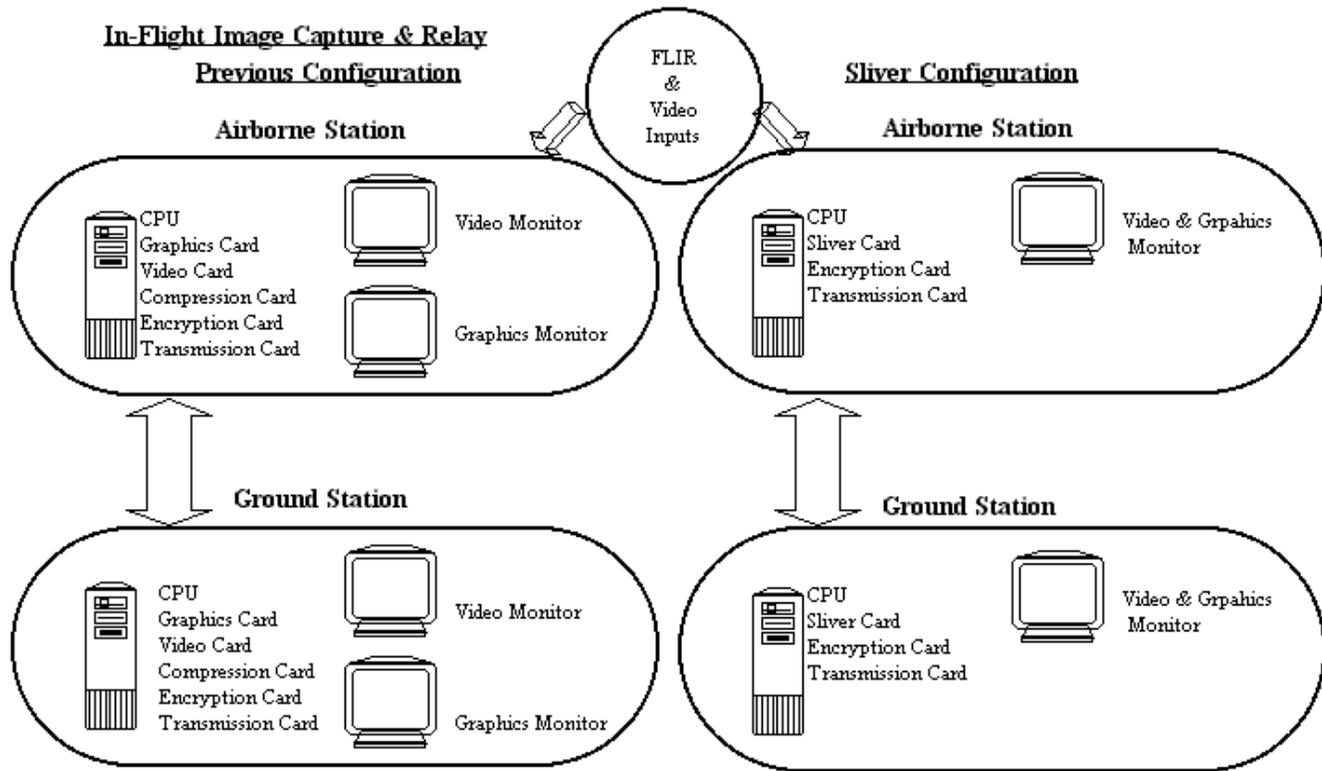
The Vigra Sliver provides maximum flexibility for meeting the system needs of a wide range of applications. Its standards based architecture smoothly accommodates most existing requirements and its modular extensibility allows for efficient configuration of the hardware resources for optimum performance. Brief overviews of some possible application scenarios are as follows:

In-flight Image Capture

These are typically military applications which involve the in-flight collection of both graphics and streaming video data (such as FLIR, video or NTSC) and the real-time relay of the data to mobile or fixed ground stations for analysis and/or command decision support. Prior to the availability of the Sliver board, the system configuration often required dual displays and separate graphics and video processors. In addition, a separate compression card was required to prepare the data for transmission to the ground station.

By combining the video and graphics overlay streams onto a single monitor, the Sliver solution eliminates the need for two separate monitors in both the inflight and ground stations. In addition, Sliver's built-in compression capability, through use of an integrated daughter board, eliminates the need for a separate VMEbus compression card. The overall systems savings from eliminating two separate graphics cards, two displays and a separate compression card

totals approximately \$30,000.

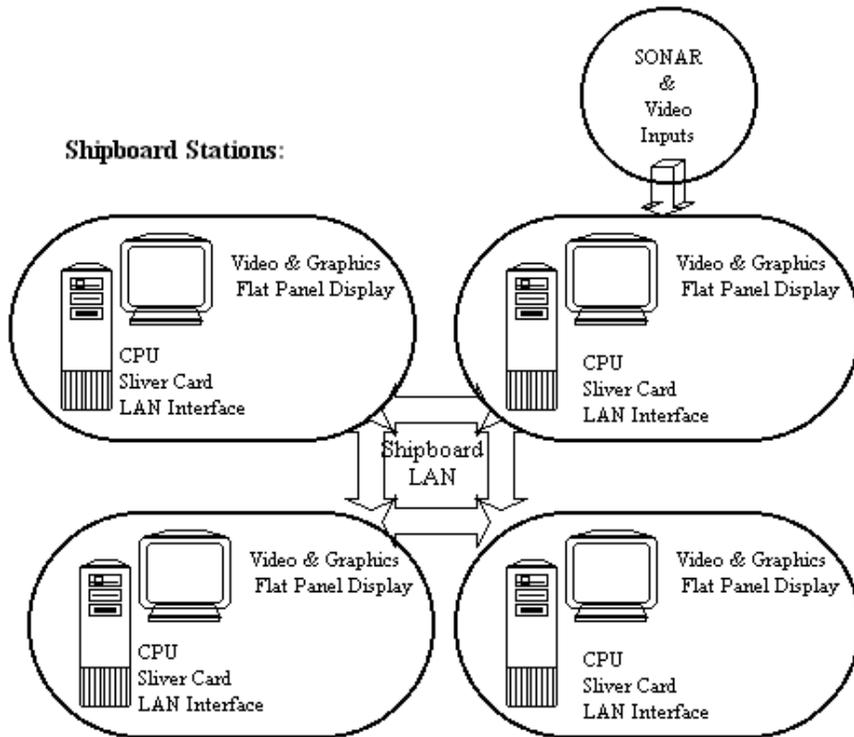


System savings: Approximately \$30K
2 displays, 2 graphics cards, 1 compression card

Not only does the Sliver Graphic Server eliminate significant costs, it also reduces the number of chassis card slots required on both the airborne and ground station sides of the system, thereby reducing overall system complexity and weight while increasing robustness and reliability.

Shipboard Command and Control

Surface ships and submarines have similar issues to in-flight data collection systems, in that they need to provide real-time integration of SONAR and video information with graphics overlays. However, rather than focusing upon transmitting the combined SONAR and video information to a separate station, the data instead typically needs to be distributed to various shipboard stations via a shipboard LAN. Because numerous stations within the ship need to share the same data, the cost savings associated with Sliver are multiplied by the number of stations. For instance, a shipboard LAN with four monitoring stations could save approximately \$60,000 through the elimination of dual monitors and separate graphics and video cards for each station.



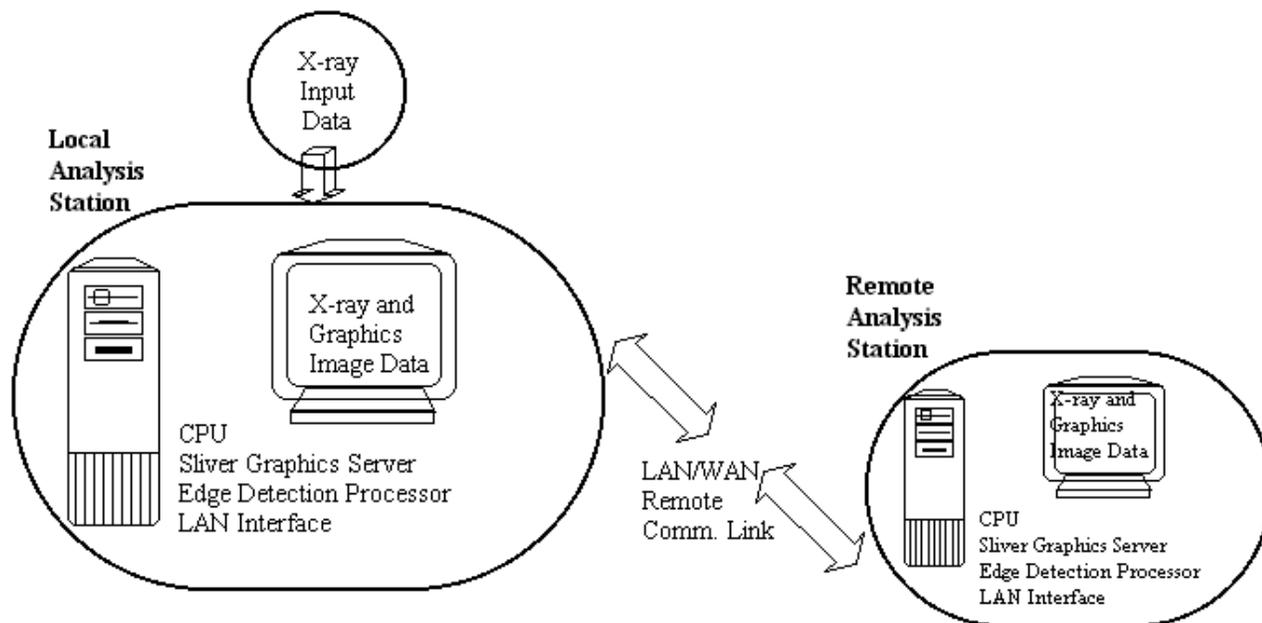
In addition to the direct cost savings, Sliver's simplification of the design, elimination of the need for multiple VMEbus slots, and its capability to support various flat panel displays provides added flexibility for space saving configurations in tight shipboard installations. Such design simplicity is vital in shipboard installations to reduce overall support cost. Where space and weight considerations are often paramount. Sliver's modular design, combining graphics, video and compression, allows designers of shipboard systems to integrate much higher functionality into smaller, more compact system designs. It also simplifies spares management.

Medical

A typical medical application for the Vigra Sliver involves the viewing, analysis and storage of X-rays. The ability to digitally handle X-ray information addresses key problems of film cost, storage space and collaborative consultation that plague today's X-ray processing. It is not unusual for a hospital to spend more than \$1 million per year on X-ray film and the storage of physical X-rays is becoming increasingly difficult since every X-ray must be retained for somewhere between 7 and 20 years. Not only are they cumbersome to store, X-rays are difficult to share since they only exist in a single copy, thereby severely restricting the ability to secure second opinions from off-site doctors. Most importantly, the analysis of X-rays is largely dependent upon visual examination by the physician and can be significantly improved by the use of graphics tools such as edge finding capability.

The Sliver board is ideally suited to such a medical application. It provides a standards-based system that allows the smooth single display combination of graphics and X-ray data on a single screen. Specialized processors for edge detection can be accessed via the 64-bit VMEbus and the results combined with the original X-ray on a single screen by Sliver. Using LAN and WAN connections, similar X-ray analysis stations can easily be used to share the data and gain second opinions from remotely located physicians. In addition, Sliver's compression options, via daughter board add-ons, can enable the most efficient storage of X-rays and also can allow for more effective transmittal of X-rays for conducting remote consultations.

Networked X-Ray Analysis Stations:

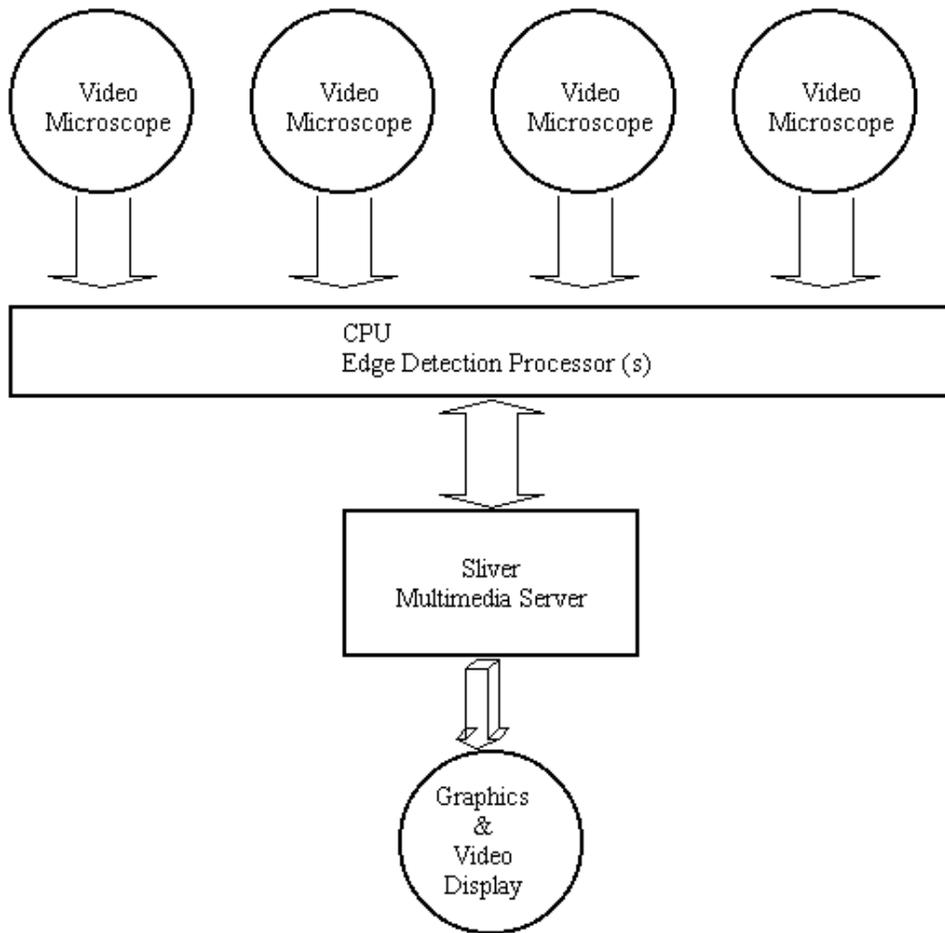


With many medical monitoring applications, audio feedback is routinely incorporated to provide warning signals, alert prompts, etc. In addition, the ability to incorporate audio files with physician comments can greatly enhance the value of remote diagnostic procedures. Sliver's capability to tightly integrate audio and video processing can be very useful in achieving these objectives. In addition, the VME form factor can provide easy integration with the high bandwidth VMEbus-based ATM communications workstations now being deployed in many hospitals.

Real-time Product Inspection and Process Control

For industrial applications, the Vigma Sliver can be used for real-time integration of inspection information and/or process monitoring data to aid in maintaining product and process quality. A typical example involves real time inspection of integrated circuits by combining high-magnification video microscopy data with edge detection processing. In order to achieve maximum efficiency, a single Sliver board can be used to combine inputs from multiple inspection devices.

Variations on this basic inspection/process control configuration can be used for a variety of product and process control applications, such as power plant monitoring, petrochemical plant monitoring and control, etc. One application currently under development would even use a similar system configuration with remote video input links to monitor and control various points throughout a high-speed railway system. Sliver's high performance modular design supports this wide range of system configurations by allowing system designers to mix and match the exact combination of required functionality without having to include the cost of unnecessary components.



Future Application Directions

In addition to its immediate applicability in the military, medical and industrial arenas, the Vigra Sliver will also open new possibilities in other areas such as communications, training, security, and entertainment.

Communications & Collaborative Computing

As many corporations and communications providers, such as Regional Bell Operating Companies (RBOCs), move toward offering videoconferencing and collaborative computing services. The Sliver board provides several options for combining video with applications data to meet these needs. For instance, Sliver's ability to display multiple text, graphics and video windows on the same display enables remotely located users, such as members of a design team, to simultaneously hold a video conference, mark-up shared drawings and exchange design data. In addition, the growing use of video-as-browsable-information over the Internet and corporate intranets requires new capabilities for effectively delivering and displaying MPEG video files. Sliver's flexibility allows it to be configured to meet the whole range of these changing requirements.

Training

The real-time combination of video, graphics and text on the same display will also have significant impact on the ability to remotely deliver interactive training information. Sliver's modular configurability will allow the targeted development of cost effective systems for deployment as both instructor and student learning stations.

Security, Surveillance & Law Enforcement

The Vigra Sliver opens new possibilities in the security and surveillance industry, such as driving access control systems that are based on matching stored video or audio data (such as palm-prints or voice-prints). In addition,

Sliver-based systems can be used to aid law enforcement analysis systems such as fingerprint search and matching systems.

High Performance Multimedia Processing for Both Today and Tomorrow

Because it is based upon the latest processing capabilities and provides the flexibility of a modular design, the Vigna Sliver is a cost effective choice for the full range of today's high performance multimedia applications. Because it incorporates both existing and emerging industry standards, and uses an extensible architecture to interface with multiple platforms and operating systems, Sliver is a safe choice to ensure continued payoff from the initial design investment.



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