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VISION AWARD 2006: the winner is Silicon Software

Visual Applets – Vision Approach Machines
Flexible hardware code for Machine Vision application

The performances of current image sensors and the usage of advanced and complex algorithms dramatically increase the need of calculating power in Machine Vision applications. Even with new processor architecture, modern PCs have problems to meet the requirements. New products of frame grabbers with powerful Vision Processors demonstrate the tendency in evacuating image pre-processing onto the grabber. Restrictions of acceptance are found in a complicate interfacing and the need of hardware experts.

Core competence of Silicon Software is the usage of reprogrammable FPGA technology for advanced application in Machine Vision. Frame grabber products can be adapted to individual requirements and arbitrary applications by loading customized hardware code. Aspects of confidentiality in algorithms and the opportunity to modify systems in time, have been initial reasons to concept a tool, which enables the customers to access the hardware of the frame grabber. This year VisualApplets was released with the first official version.

Hardware and software programs strongly differ in the efficiency of certain applications and also in limitations or restrictions. Strength of software programming is the sequential character, which supports decisions and user entries. However hardware programming has a strong parallel character. Data are transferred through the hardware similar to a pipeline system. Data are synchronously transmitted, processed and combined.
The processing performance in hardware increases that one of the software processing by a multiple factor. Therefore a requirement in the accuracy of the timing is very high. Problems in synchronisation and side effects are common reasons of non-functional hardware programming.

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Compared to the advantages of speed by a multiple factor, the expenses of hardware programming exceed that one of software programming by a multiple. These expenses and the availability of experts prevent a spreading of hardware based image pre-processing at the moment.

VisualApplets was developed on the condition that it will be accepted by hardware and software engineers, the user focus his concentration on the creation of the application by an intuitive user-interface, and the user won't be burdened by complex and hardware-related configurations and settings.
VisualApplets was developed as a tool for an application engineer in Machine Vision as a matter of priority.

Novelty in hardware development is the programming on operator base. In the most cases a so-called core is loaded, which enables the use of a limited set of pre-processing. In contrary to that, VisualApplets uses filter and operators to create data flow de-

signs. VisualApplets doesn't require special knowledge in hardware. The available functions are adapted to the "language of the software engineer". The engineer develops hardware on algorithmic base.

Base for new opportunities in hardware programming is an internal R&D product of a hardware description language and new FPGA programming methods, which are currently pending by patents. These methods enable a highly flexible combination from different hardware based functions. New principles are implemented to modularise the hardware programming but also regard the relations of the complete design. Nevertheless the method enables a control of the synchronisation, relation in the circuitry and an automatically correction of the timing. Side effects are checked and corrected during the creation of the design. Consumption of the hardware resources and the data throughput are calculated on module base. The user is warned in case of bottlenecks.

Existing standard interfaces of Machine Vision industry were implemented. Recently developed interfaces can be added as new modules. VisualApplets operates hardware independent in principle. The integration of and connection to hardware is implemented in a general way. VisualApplets programming tool is able to support hardware products of different manufacturers in the next versions, as well as run existing hardware code on different hardware platform of third parties.

The algorithmic in VisualApplets is visualized in a data flow diagram. This element is used as expression construct for the definition of the pre-processing design. The functional blocks of the FPGA layout are generated from these schemes afterwards.
Data flow designs are intuitively created by graphical modules from hardware libraries. The modules are combined and connected. Already today the libraries contain classical filter operations i.e. from arithmetic, logical comparisons, morphologic, general filter operations or color processing operations.

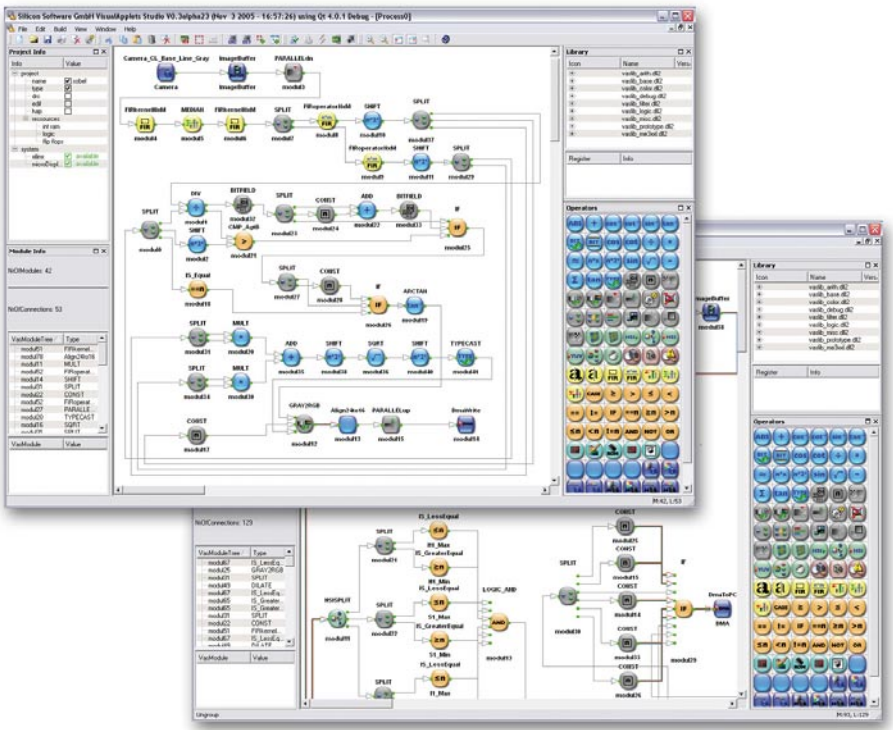
VisualApplets operates without any mandatory need of code. Configurations and parameterisations are controlled by intuitive list fields. Errors and warnings are automatically corrected or graphically displayed. The visual result can be simulated and checked at any point of the design flow. The user has control of his application by indication of the resource reserve and consumption, the estimated and calculated data throughput.

A run-time hardware code can be created after finishing of the design process. This process doesn't need any operation of the user. There is no examination of necessary synchronisation, timing or problems with side effects. A VHDL compiler is not required. A synthesis as well as a high level simulation is included in the software.

A ready-to-run hardware applet is created after 10-15 minutes by average and can additionally be parameterised and controlled by software.

Visual Applets strongly combines hardware- and software programming. Even complex requirements of Machine Vision applications, which only can be solved by experienced teams, complex procedures, by advanced financial and temporal expenses, are solvable now by small teams in an adequate time and budget at an immediate demonstration of the results.

It is the first time, that Machine Vision companies are able to develop hardware based solutions with their existing employees of software programmers and application engineers.



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[published in Vision Focus, official exhibition magazine by Quality Engineering, issue of 8th November 2006]