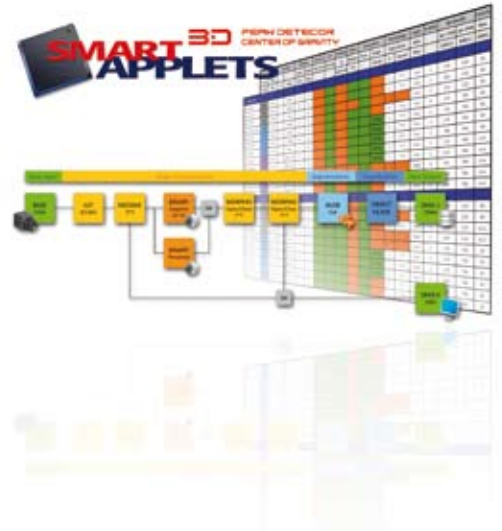


SmartApplets

Accelerating application related functions by FPGA processing with „configuration instead of programming“

The outsourcing of parts of an image processing onto a frame grabber with FPGA-processor reduces the load of the PC system substantially. Despite obvious advantages, a lack of resources in hardware programming is a frequently cited problem. In most applications, standard image processing operations are needed to reduce the amount of data at high quality.

Silicon Software has developed the SmartApplets image processing libraries for this purpose. It covers application-related feature sets, the so-called hardware applet. In contrast to the image acquisition applets that provide basic functionality and advanced pre-processing, SmartApplets caters ones with specific application-oriented focus. They offer multi-level image processing that can be adjusted via parametrization on the deployment system.

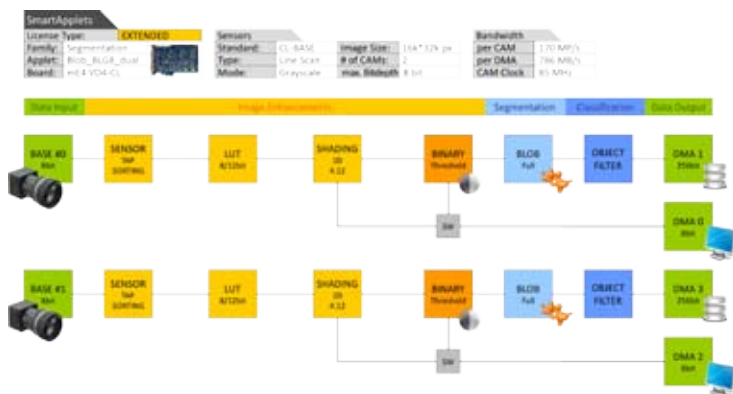


SmartApplets are divided into application-specific product families. Each one includes several hardware applets that are optimized for pre-defined frame grabbers and functions. The performance benchmarks and functional blocks of the individual feature sets can be compared by product matrices and helps selecting the appropriate SmartApplets.

Currently „binarization“, „object segmentation and classification“ and „3D laser triangulation“ are available as SmartApplets families.

Special feature of the binarization is the use of an adaptive processing on large filter kernel. The threshold is determined by its local neighborhood and provides even for inhomogeneous image content an optimal image separation. The object segmentation works on a 1D or 2D blob analysis. It even handles large amounts of image data and a high number of objects in real time. The objects are separated and transferred with their geometrical properties. To classify

objects, the properties can be used as selection criteria in order to transmit only relevant objects. Highlight of the 3D laser triangulation is the use of the „Peak Detector“ algorithm of the company Aqsense. It processes image data without need of a threshold. It is robust and highly accurate, even with problematic object colors. As SmartApplets type it supports 10-taps FULL configuration cameras up to 850 MBytes/s.

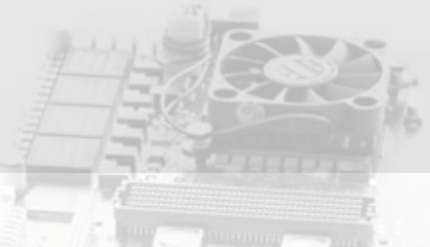


Block diagram of a SmartApplets for object segmentation and classification

SmartApplets can be operated with V-series of Camera Link and GigE Vision frame grabbers. SmartApplets be constantly expanded by content and functions. SmartApplets will also be available for V-series frame grabbers of CoaXPress and CameraLink HS.

Any information without obligation. Technical specifications and scope of delivery are liability-free and valid until revocation. Mistakes are excepted.



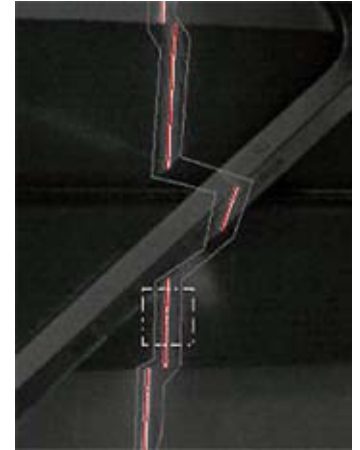
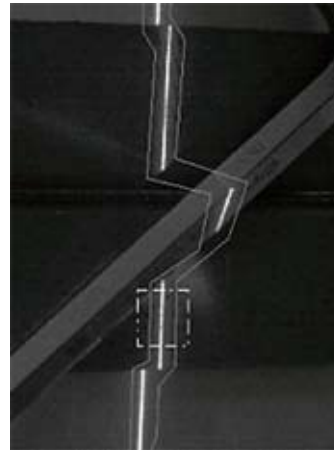
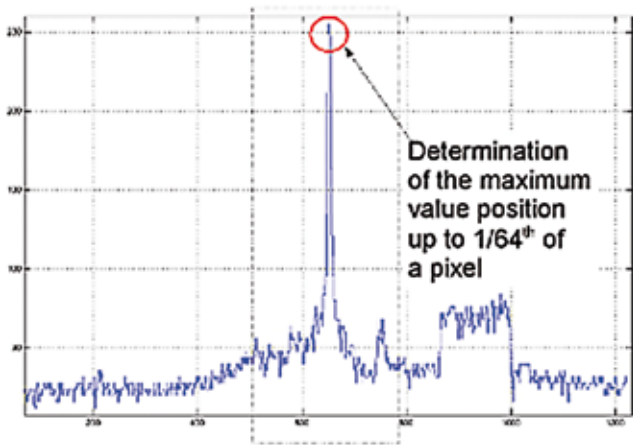


	Board		CamPort	Bitdepth		Sensor	LUT		Shading	Noise	Binarization	Morphology		Segm.	DMA		Bandwidth		CamClk
	mE4	Max.		Input	Output		Tap Corr.	8/12 bit				1D	Median		Thres.	Adapt.	Open/Close	Blob	
	CL/GE	[Px]	#	Type	[bit]	[bit]		mult-sub	3*3			Kernel	#	Kernel			[MP/s]	[MB/s]	[MHz]
Area Scan																			
Bin_BAG8	VD1	4k*4k	1	BASE	12	8					32*32	2	5*5		2	170	210	85	
Bin_BAG12	VD1	4k*4k	1	BASE	12	12					32*32	1	5*5		2	170	210	85	
Bin_FAG8	VD1	4k*4k	1	FULL	8	8					32*32				2	500	210	62.5	
Bin_BAG8	VD4	4k*4k	1	BASE	12	8					64*64	2	7*7		4	170	794	85	
Bin_BAG8_dual1	VD4	4k*4k	2	BASE	12	8					32*32				2	170	794	85	
Bin_BAG8_dual2	VD4	4k*4k	2	BASE	12	8					32*32				2	170	794	85	
Bin_BAG12	VD4	4k*4k	1	BASE	12	12					64*64	2	7*7		2	170	794	85	
Bin_FAG8	VD4	4k*4k	1	FULL	8	8					64*64	1	3*3		2	850	794	85	
Bin_GAG8	VQ4	4k*4k	1	GigE Vis.	12	8					64*64	2	7*7		2	128	794	n/a	
Bin_GAG12	VQ4	4k*4k	1	GigE Vis.	12	12					64*64	2	7*7		2	128	794	n/a	
Bin_GAG8_dual	VQ4	4k*4k	2	GigE Vis.	8	8					32*32	1	7*7		2	128	794	n/a	
Line Scan																			
Bin_BLG8	VD1	8k*65k	1	BASE	8	8					32*32	1	7*7		2	170	210	85	
Bin_BLG12	VD1	4k*65k	1	BASE	12	12					32*32	1	5*5		2	170	210	85	
Bin_FLG8	VD1	4k*65k	1	FULL	8	8					32*32	1	5*5		2	170	210	62.5	
Bin_BLG8	VD1	16k*65k	1	BASE	8	8					64*64	2	5*5		2	170	794	85	
Bin_BLG12	VD4	16k*65k	1	BASE	12	12					32*32	1	7*7		2	170	794	85	
Bin_MLG8	VD4	16k*65k	1	MEDIUM	8	8					64*64	2	5*5		2	340	794	85	
Bin_FLG8_2	VD4	16k*65k	1	FULL	8	8			*		64*64	2	5*5		2	850	794	62.5	
Bin_FLG8	VD4	16k*65k	1	FULL	8	8			*		32*32	1	5*5		2	850	794	85	
Bin_FLG8_3	VD4	16k*65k	1	FULL	8	8			*		32*32	1	3*3		2	850	794	85	

Feature matrix for SmartApplets of binarization family

	Board		CamPort	Bitdepth		Sensor	LUT		Shading	Noise	Binarization	Morphology		Segm.	DMA		Bandwidth		CamClk
	mE4	Max.		Input	Output		Tap Corr.	8/12 bit				1D	Median		Thres.	Adapt.	Open/Close	Blob	
	CL/GE	[Px]	#	Type	[bit]	[bit]		mult-sub	3*3			Kernel	#	Kernel			[MP/s]	[MB/s]	[MHz]
Area Scan																			
Biob_BAG8	VD1	4k*4k	1	BASE	12	8					32*32	2	5*5		2	170	200	85	
Biob_BAG12	VD1	4k*4k	1	BASE	12	12					32*32	2	7*7		2	170	200	85	
Biob_FAG8	VD1	2k*4k	1	FULL	8	8					32*32				2	850	200	85	
Biob_BAG8_dual	VD4	4k*4k	2	BASE	12	8					32*32	2	5*5		4	170	250	85	
Biob_BAG8	VD4	4k*4k	1	BASE	12	8					32*32	2	7*7		2	170	250	85	
Biob_BAG12	VD4	4k*4k	1	BASE	12	12					32*32	2	7*7		2	170	250	85	
Biob_FAG8	VD4	4k*4k	1	FULL	8	8					32*32	1	3*3		2	850	750	85	
Biob_GAG8	VD4	4k*4k	1	GigE VIL	12	8					32*32	2	7*7		2	128	128	n/a	
Biob_GAG12	VD4	4k*4k	1	GigE VIL	12	12					32*32	2	7*7		2	128	128	n/a	
Biob_GAG8_quad	VD4	4k*4k	4	GigE VIL	8	8					32*32	2	7*7		4	128	125	n/a	
Biob_GAG8_dual	VD4	4k*4k	2	GigE VIL	8	8					32*32	2	7*7		2	128	125	n/a	
Biob_GAG12_dual	VD4	4k*4k	2	GigE VIL	12	12					32*32	2	7*7		2	128	125	n/a	
Line Scan																			
Biob_BLG8	VD1	16k*65k	1	BASE	8	8					32*32	1	7*7		2	170	200	85	
Biob_BLG12	VD1	16k*32k	1	BASE	12	12					32*32	1	5*5		2	170	200	85	
Biob_MLG8	VD1	16k*65k	1	MEDIUM	12	8					32*32	1	3*3		2	340	200	62.5	
Biob_MLG12	VD1	16k*65k	1	MEDIUM	12	12					32*32	1	5*5		2	340	200	62.5	
Biob_BLG8_dual	VD4	16k*32k	2	BASE	8	8					32*32	2	7*7		2	170	250	85	
Biob_BLG12	VD4	16k*65k	1	BASE	8	8					32*32	2	7*7		2	170	250	85	
Biob_MLG8	VD4	16k*32k	1	BASE	12	12					32*32	1	3*3		2	170	250	85	
Biob_MLG12	VD4	16k*65k	1	MEDIUM	8	8					32*32	2	5*5		2	340	500	85	
Biob_MLG12	VD4	16k*65k	1	MEDIUM	12	12					32*32	2	7*7		2	340	500	85	
Biob_FLG8	VD4	16k*65k	1	FULL	8	8			*		32*32	1	7*7		2	850	750	85	

Feature matrix for SmartApplets of object segmentation and classification family



„A single point obtained for each line across the laser stripe at subpixel accuracy of 1/64 pixel (max). Lab tests revealed 5 microns in Z, with a FOV of 130m.“

Accuracy features of Peak Detector in SmartApplets 3D family, © Copyright of images by Aqsense.

Available or planned SmartApplets products:

Standard / Product	Description
SmartApplets	
SmartApplets	Binarization
SmartApplets	Object segmentation and classification
SmartApplets	3D featuring Peak Detector and Center-of-Gravity



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