Intelligent Cameras

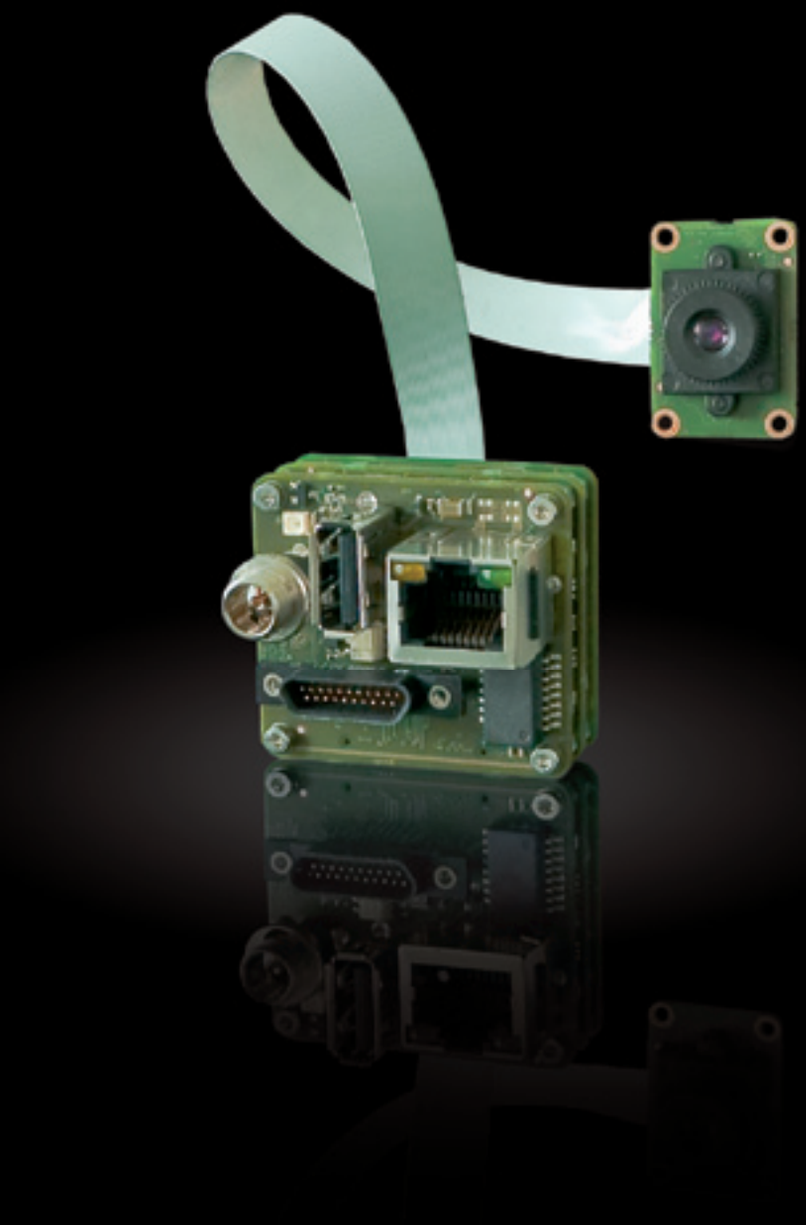
Programmable, Linux-Based Cameras
300 MHz ARM / 600 MHz DSP with 4800 MIPs
Aptina, CMOSIS and Sony Sensors
From VGA to 4.2 Megapixels

Cameras | Made in Germany

VRmagic

Linux-Based Intelligent Cameras

Intelligent cameras from VRmagic are equipped with the DaVinci™ processor from Texas Instruments, featuring a 300 MHz ARM9 processor, and a 600 MHz DSP with 4800 MIPs. Running on a standard Debian Linux operating system, the freely programmable components can be used just as an embedded PC. Developers can transfer their own applications to the camera conveniently by means of a cross-compiler. Image processing tasks – such as decisions on position, completeness or quality – are performed directly in the camera.



Sensor Features

- Rolling shutter, global shutter, or interline transfer
- CMOS or CCD sensors
- Resolutions from VGA to 4.2 Megapixels
- Monochrome or color with Bayer RGB matrix

Embedded System

- 300 MHZ ARM9 processor
- 600 MHz C64x+ DSP with 4800 MIPs
- 256 MB RAM
- 512 MB flash memory
- Standard Debian Linux
- UBIFS file system
- Same API on camera and host
- Cross compiler

Supported Interfaces

- 100 Mbit Ethernet
- USB Host
- RS232
- Trigger and strobe
- General purpose I/O (2in/3out)
- Analog video output (S-Video)
- Digital video output HDMI/DVI (optional)
- AC97 audio codec (optional)
- Additional GPIOs (optional)

Available Designs

- High quality aluminium housing, standard C-mount optics (not included)
- Board level camera with or without optics
- Board level camera with offset sensor
- Custom-built form factor

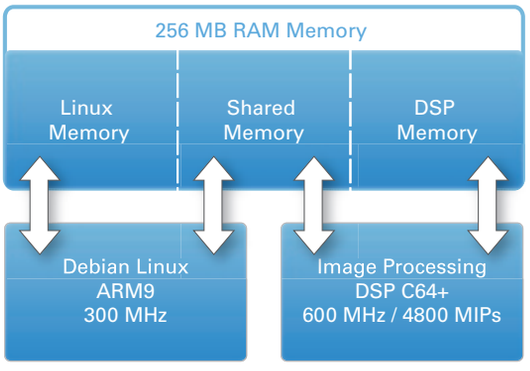
ARM/DSP Dual Core Programming

Convenient Application Programming

With a standard Debian Linux operating system and full access to the ARM/DSP processor from Texas Instruments, the intelligent cameras from VRmagic provide developers with a convenient platform for programming their own applications with C/C++ or any common programming language. Algorithms can be developed with standard environments such as MS Visual Studio or Code Composer Studio and transferred to the camera by means of cross-compilers. Host system and camera have the same API.

Parallelization of Image Processing on the Dual Core Chip

Intelligent components feature a highly-integrated dual core chip from Texas Instruments with parallel processing architecture. The DSP is entirely available for image processing tasks.



Communication between DSP and ARM is carried out through the TI Codec Engine. For the DSP, Texas Instruments offers various open source algorithms for image processing as well as closed source commercial codecs.

TI Libraries

- C64x+IMGLIB
- C64x+DSPLIB
- JPEG
- H.264 Codec
- etc.

Open-source Projects

Open-source projects with the target platform Linux run without problems on the intelligent cameras. Linux also provides drivers for USB devices such as WLAN or Bluetooth sticks, as well as hard disks or mouse and keyboard input devices.

Fast Compiling

- Complete pre-configured ARM tool chain for Windows and Linux on CD *free of charge*
- Downloadable TI DSP compiler and tools, *120 day trial version available*

Easy Debugging

- Same API on host and intelligent camera; Testing of camera application on host possible (ARM only)
- Remote-debugging via Ethernet, for example with Eclipse and gdbserver (ARM only)
- TI TraceUtil enables printf-debugging of DSP code
- JTAG port for connection with real-time emulators (XDS510 or XDS560) and DSP debugging with CCS

Easy Data Transfer Between Camera and Host

- Windows/Samba-share
- NFS or FTP server/client
- USB-stick etc.

Software Development Kit

Features of the Software Development Kit

The free software development kit contains a single API that works with all models from VRmagic. The self describing property interface allows for generic code development - an exchange of the camera model later on is thus possible without additional programming. The provided user interface allows unlimited access to the uncompressed sensor data. Demo applications and free source code for several developing platforms are included.

Demos including Sources on CD

- Bayer/Grey to RGB565 converter on ARM or DSP
- Demo for integration of customer specific DSP codecs (JPEG, Sobel, etc.)
- Viewer for S-Video output (DirectFB and SDL)
- Control of general purpose I/O's

< The CamLab of the VRmagic SDK allows users to control important sensor parameters via the graphical user interface.

Rescue USB-Stick for Simple Updates and Inexpensive Maintenance

Updates of the application software running on the intelligent camera can be applied in just a few minutes with the Rescue USB-Stick from VRmagic. Developers can create their own update stick by means of a simple script. This stick can then be used to install the current software version on a camera.

The Rescue USB-Stick can also be used to restore a camera's internal Linux operating system to its factory state quickly and easily if necessary. This can be done by simply connecting the USB-stick to the USB host port of the camera and then rebooting the camera.

The Rescue USB-Stick is included in the accessory package.

Programming Libraries

VRmagic Image Library (ARM and DSP)

VRmagic has developed a codec based on the TI Codec Engine, which converts the image data of the sensor into different target formats such as RGB32, RGB24, RGB565, YUV, GRAY, or RLE.

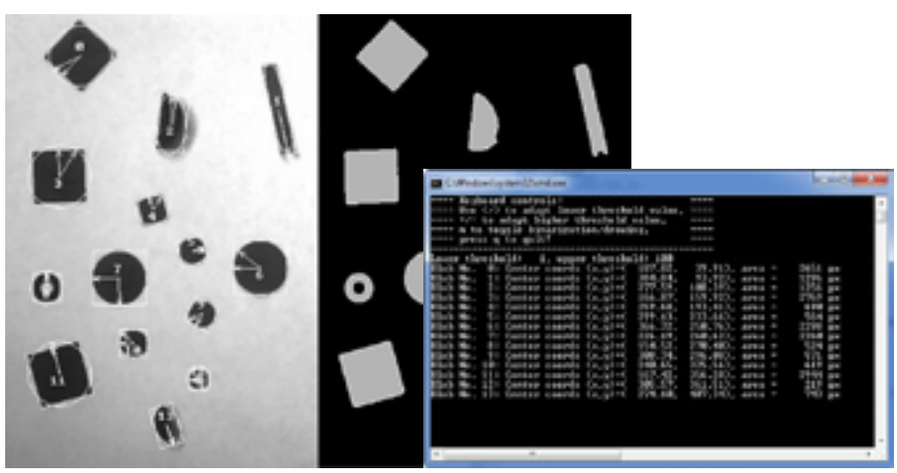
VM_LIB

The VM_LIB is a machine vision library included* in VRmagic´s SDK for use on the intelligent cameras. It contains various fully developed algorithms (C functions) for industrial imaging tasks, such as edge detection, pattern recognition, bar code scanner, blob segmentation, and many low-level functions such as tresholding or erosion/dilation. All code is optimized for the DSP of the DaVinci™ SoC for the intelligent cameras from VRmagic, but also runs on the ARM core as well as PC platforms under Linux and Windows (x86). Demo source codes for DSP and PC are included in the SDK.

*License agreements are required if it is wished to distribute an application as part of a product.

VRmagic GStreamer Plugin

GStreamer is a multiplatform, open-source library that provides a wide range of fully developed codecs and filters for multi-media applications, which users can combine arbitrarily. The VRmagic SDK provides a GStreamer plugin for image grabbing, camera control and color conversion on the DSP, as well as for integrating custom codecs. Additionally, Texas instruments has created a GStreamer Plugin offering easy integration of various DSP side codecs (h264, mpeg4, jpeg) into the processing pipeline. Because of the generic interface of GStreamer, applications can take advantage of advances in codec and filter technology without additional programming. GStreamer supports various IP streaming protocols (TCP, UDP, RTP, RTSP), thus enabling Ethernet streaming of processed image data.



< Blob segmentation is one of the various fully developed algorithms for image processsing tasks included in VM_LIB.

Available Designs

Intelligent cameras from VRmagic are available as

- Board Level Camera (OEM Series)
- Board Level Camera with Lens (COB Series)
- Camera in Housing of High Quality Anodized Aluminum with C-mount (PRO Series)

OEM Backends with PicoBlade™ Connectors

For applications requiring a more compact design, the standard backend of the board level cameras can be exchanged with a Molex PicoBlade™ backend featuring miniature connectors for all interfaces of the standard backend.

Optional Digital Video Output Interfaces

An RGB888 interface of the PicoBlade™ backend allows for connecting an additional DVI or HDMI interface on an external board to the camera using a flexible printed circuit cable. The camera sensors can be synchronized to the RGB888 video output.

^ External board with HDMI interface

Intelligent OEM Camera with offset sensor ^

Special Designs with Offset Sensor

For applications with tight or angled installation space VRmagic offers cameras with freely positionable offet sensors (eOEM/eCOB series). The sensor is connected to the main unit by an up to 50 cm long flex-foil cable with LVDS transmission.

Ultra Precise Sensor Positioning

All PRO cameras that feature the Sony or CMOSIS sensors are assembled using ultra precise sensor positioning.

Camera Features

- Individual adjustment of exposure time, pixelclock, auto exposure, gain, auto gain, and white balance
- Correction of gamma, luminance, and contrast via look-up tables
- Freely definable ROI (region of interest)
- Unrestricted access to raw sensor data
- Trigger/strobe settings
- Soft-trigger, timestamps, framecounter

Sensor Characteristics

	VRmDC-8	VRmDC-9	VRmDC-12	VRmDC-14	VRmDFC-22	VRmDFC-42
Manufacturer	Aptina	Aptina	Aptina	Sony	CMOSIS	CMOSIS
Type	MT9T001	MT9M001	MT9V022	ICX445	CMV2000	CMV4000
Technology	CMOS	CMOS	CMOS	CCD	CMOS	CMOS
Shutter	rolling	rolling	global	interl. transfer	global	global
Ultra Precise Sensor Positioning ①	–	–	–	●	●	●
Color	●	–	●	●	●	●
Monochrome	–	●	●	●	●	●
Sensor Size	1/2“	1/2“	1/3“ wide	1/3“	2/3“ ultra wide	1“
Resolution	2056 x 1544	1288 x 1032	754 x 480	1296 x 966	2048 x 1088	2048 x 2048
Pixel Size [µm]	3.2 x 3.2	5.2 x 5.2	6 x 6	3.75 x 3.75	5.5 x 5.5	5.5 x 5.5
FPS	13	30	69	22 ②	28 ②	15 ②
Min. Exposure Time	60	38	30	to be defined	to be defined	to be defined
Bit Depth	8/10	8/10	8/10	8/10(/16)	8/16	8/16
Pixelclock [MHz]	5 ... 48	5 ... 48	5 ... 26.6	36 ②	30 ②	30 ②

① only PRO models with aluminum housing ② subject to change

Physical Characteristics

	VRmDC-8	VRmDC-9	VRmDC-12	VRmDC-14	VRmDFC-22	VRmDFC-42
OEM Board Size [mm]	42 x 38 x 35 (22)			42 x 38 x 36 (23)	42 x 38 x 43 (30)	
COB Board Size [mm]	42 x 38 x 48 (36)			42 x 38 x 48 (36)	not available	
PRO Housing Size[mm]	46 x 42 x 51			46 x 42 x 52	46 x 42 x 59	
eOEM Size [mm]						
Main Board	42 x 38 x 35 (22)	42 x 38 x 35 (22)	42 x 38 x 35 (22)	42 x 38 x 35 (22)	not available	
Sensor Board	42 x 38 x 7	42 x 38 x 7	28 x 19 x 7	42 x 38 x 9		
eCOB Size [mm]						
Main Board	42 x 38 x 35 (22)	42 x 38 x 35 (22)	42 x 38 x 35 (22)	42 x 38 x 35 (22)	not available	
Sensor Board	42 x 38 x 20	42 x 38 x 20	28 x 19 x 11	42 x 38 x 20		

All dimensions W x H x D without lens and including connectors. Dimensions in brackets apply to depth of backends with PicoBlade™ connectors.

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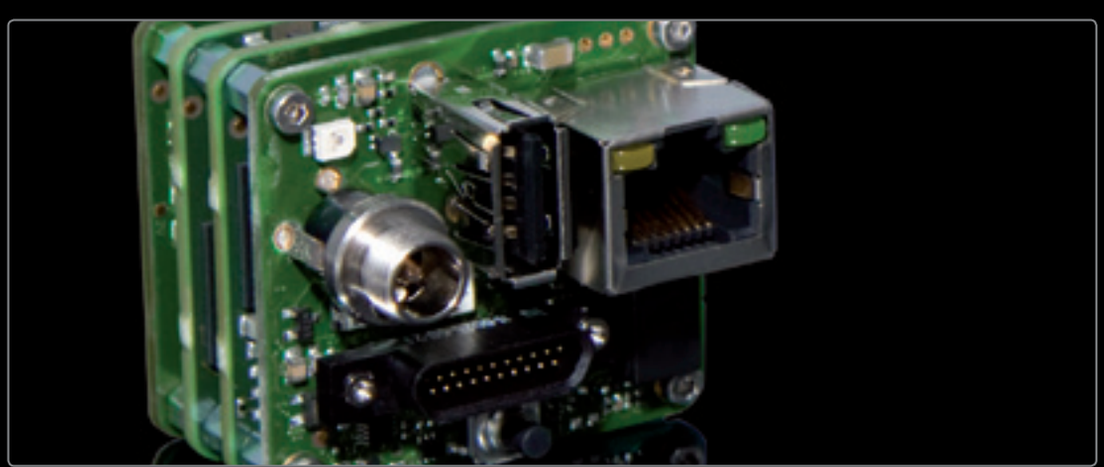

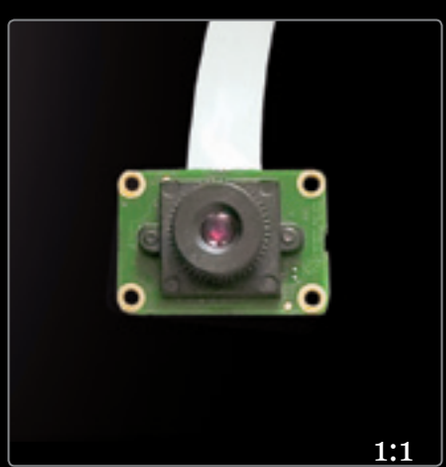

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