NEXVISION
eyetronic

GOLD
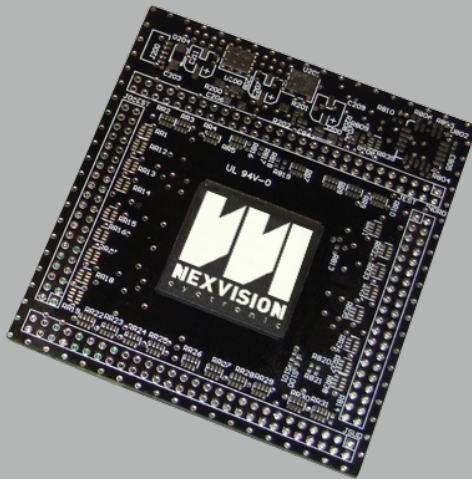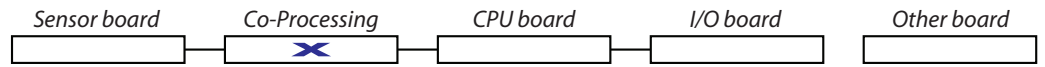
Powerfull platform and expertise services
Image Processing Library & algorithms
Porting support to FPGA

Sensor board	Co-Processing	CPU board	I/O board	Other board

PIX TERA

Hardware-Accelerated
Image Co-Processor
Reference Design

RoHS ARM POWERED

OVERVIEW

- Hardware video processing, up to a tera operations per second (10^{12}), FPGA/HDL based
- User accessible image processing framework environment to speed-up algorithm portage
- Nexvision's image pre-processing advanced algorithm library
- Nexvision's technical support for MATLAB or C to HDL coding optimization

IP SAMPLES

- Deconvolution
- Fusion of multiple shoot
- Optical enhancement and corrections
- Vibration stabilisation
- Compression/decompression
- Human body detection
- Shape, character recognition
- Traffic accident detection, behaviour & flow control
- Depth map
- 3D scene reconstruction

REFERENCE DESIGN PROCESS

1 Order a Nexvision Reference Design

2 Update your Specifications

3 Get your product Ready to sell

www.nexvision.fr

Features

* High performance FPGA (Field Programmable Gate Array), based on latest 28nm process, low power
* Ultrafast & High resolution frame grabbing and processing - 12Mpixel@180fps
* Low Size, Weight and Power (SWaP)
* Support up to 4 independent video sensor boards

Applications

• Opto-electronics devices
• Multimedia processing
• Gyrostabilised video (broadcast, defense) on UAV
• Vision based vehicle guidance system or driver augmented reality
• Multispectral video boarder surveillance
• Multitarget video tracking
• Night vision, 3D range gating active imaging
• Blind Deconvolution
• Crypto accelerator
• Printed board, circuit board and LCD inspection
• Cinema video camera with real time effects
• Video post-production processing
• Automated license plate recognition (ANPR)
• High end digital signage or real time interactive showcase
• Compact low weight , low power consuming vision solutions
• Video camera with CPU intensive image processing (hand held smartcam)
• Multispectral / Immersive / Omnidirectional 360° camera (virtual speedome)
• Embedded video enhancement and image analysis,
indexing before compression & transmission

Market

• Vision
• Defense
• Medical image processing
• Transport
• High end video surveillance (boarders, urban, CCTV).
• Industrial process supervision and visual inspection
• Law enforcement & forensic
• High end multimedia
• High-Performance Computing (HPC)

Image & Video processing power

• Unprecedented video pixel-crunching abilities
• Highly parallelized/vectorial pixel processing
• Multicore Single-Instruction-Multiple-Data (SIMD) processing
• High bandwidth pixel-video random access streams on local FPGA SRAM & external QDR-SRAM
• High bandwidth pixel-video linear access streams on external DDR3-SDRAM
• Very low latency

HDL coding development environment

• Developer is free to focus on algorithm development
and optimization (C/MATLAB/software/HDL coding only),
as the hardware video architecture is already defined.
• Reduced integration time
• Upgrade path for new features and performance enhancements

Memory

DDR- SDRAM (high capacity, high speed)
• 6 x banks DDR3 1066MHz
• 2Gbits per bank, 16bits bus

SRAM (high speed, low random read access latency)
• 2 x QDR III @ 600MHz
• 144Mb per bank, 18bits bus

Video Input/Output 30 pin FPC connectors

VIDEO INPUT
• 4 independant video sensor board , each up to 200Mpixel/s, 16 bits
• Free format : RAW bayer 10/12 bits, RGB422, ITU-BT1120, …

VIDEO OUTPUT
• 2 x 200Mhz 16 bits

Control and Data Input/Output

• PCI Express x4 Interface

Power supply and physical dimensions

• **Input : 5VDC, 20W max**
• Processing Board : 93mm (L) x 60mm (l) x 8mm (h)
• Temperature : 0°C to 50°C (-40°C to +85°C optional)
• Humidity : 10 – 90% non condensing

Typical Processing Algorithms

IMAGE ENHANCEMENT
• Image sensor processing
  - CFA Bayer pattern to RGB (demosaïcing), state of art non linear algorithms for very high quality color interpolation (*)
  - Auto exposure : fast adaptive for highly changing scene illumination conditions (*)
  - Multi-exposure or multiresolution, on a frame by frame basis (*)
  - Color matrix correction : dynamic, scene and illumination measurement based (*)
  - Automatic white balance - Application specific (*)
  - Gamma conversion & YUV/HSI color conversion, histogram, logic, LUT mapping, segmentation, and thresholding (*)
  - Dead pixel correction
  - IR sensors non uniformity correction (*)
  - Anti flickering (*)
• Image shoot enhancement
  - Dynamic local tone mapping (Shadows and highlights)
  - High dynamic range (16bits resolution based)
  - 3D noise Filter (spatial-temporal). (*)
  - Contrasts and edges enhancement (algorithm type : USM - unsharp mask) (*)
  - Spatial filters
• Deconvolution (*)
  - Image reconstitution model which integrate bayer pattern and color aberration (*)
  - Parallel algorithm on fpga which deconvolves the image using recursive algorithm which converge in few iterations. (new patent pending approach) (*)
  - Process of Deconvolution which integrate the sensor's noise and which improve the denoising or the deblurring in function of user's goal (*)
  - Myopic deconvolution to estimate the psf of optical and atmospherical aberration (based on fractal found in natural image) (*)
  - Lens defocused mechanically to estimate the psf (*)
  - Motion of camera could be integrated in deconvolution process (*)
  - Multi-channels deconvolution (*)
• Frequency domain transformation
• Fusion
  - Multiple shoot and/or multi angle of view in multiple spectral band : visible, Shortwave InfraRed and Thermal InfraRed (MWIR/LWIR), Terahertz, etc…)
  - Fusion with non-linear co-registration warping algorithm that corrects for visible+VNIR+SWIR versus thermal IR parallax and optical distortions
• Autofocus : real time focus tracking with lens control loop (*)
• Optical enhancement and corrections
  - Optic's aberrations corrections and super-resolution (*)
  - Atmospherical aberration correction (*)
  - Lens distorsion correction
  - Lens distorsion lateral and longitudinal chromatic aberrations, vignettage (relative illumination) correction
  - Lens barrel distorsion distorsion correction
  - Ultra wide angle lens projection correction (360° « FishEye » circle image real time dewarping) (*)
  - Co-optronics designed optics : extended depth of view/digital autofocus - wave front coding
  - Anisotropic 2D image scaling
• Vibration Correction – Video stabilisation
  - Close control loop multilevel stabilisation depending on amplitude-period (mechanical, optical, electronic and software)
  - Lens/mirror piezoactuator stabilisation control for angular movement correction (yaw and pitch)
  - Piezo-microactuator image sensor micro-scanning stabilisation control (close loop with 6 axis gyro-accelero sensors Nexvision's "MULTILINK" board) (*)
  - Motion compensation : virtual windows counter motion centring using feature points video tracking
  - Viewer pointed, automatic target tracking (gyrostabilized pan-tilt-zoom)
• Virtual pan-tilt-zoom
  - Ultra high resolution video (X-HD^{TM}) (*) with Nexvision IMA12MC
  - Multiple video sensors stitching to create panoramic images (*) with IMAPANO
  - 360º high-resolution, real-time dewarp video (*)
• 2D/3D calibration
• Compression/decompression
• Studio visual effects
• Back ground discrimination, correlation, gradient operation, Hough transformation, morphology, projection, edge thinning, line verification, rule based post processing, convolution, motion adaptive deinterlace, image restoration, etc...
• User define algorithms

IMAGE ANALYSIS

• Feature points extraction and analysis
• Fire detection
• Pattern matching
• Texture recognition
• Suspicious stationary object detection
• Content based retrieval & Query-by-content
• Sensors fusion (GIS positioning, accelero-gyro, ultrasound, radar, ..)
• Multispectral band facial biometric recognition (Visible/SWIR/LWIR)
• Depth map
• 3D scene reconstruction
• Registration - unified scene alignment – translation & scaled perspective
• Traffic accident detection, behaviour & flow control
• Color analysis
• 1D and 2D measurements
• 1D and 2D code reading and verification

• Motion detection (*)
• Human body detection
• Shape, character recognition
• Visitors/pedestrian counting
• Multi-modal gesture recognition

*(*) indicate NEXVISION'S image & video processing algorithm
and image processing primitives library (hardware implemented IP)*