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SMART HIGH SPEED CAMERA
ProcImage250
MONOCHROME VERSION

High speed video available for everybody
with smart triggers and embedded image processing

Based on a motherboard with a Spartan 3 FPGA, a fast SRAM and a USB 2.0 interface, the ProcImage250 performs high speed videos very simply and also implements smart triggers to optimize movie capture, and embedded image processing in real time to transfer only useful data. Just use a standard PC. No need for a specific acquisition card.

Main specifications

- Sensor resolution: 640 x 480 pixels
- 252 fps at full resolution and up to 54 000 fps with ROI*
- Real time recording on hard drive
- Abilities to process images in real time into the camera and/or the PC
- Configurable ROI in size and position
- Monochrome
- Embedded programmable component Spartan 3
- Internal memory, SRAM type 8 MB
- I/O: Trigger In/Out, Synchro In/Out, Strobe Out
- Smart Triggers (option)
- Embedded image processing (option)
- Standard USB 2.0 interface (Power supply and data transfer)
- Simultaneous operation of several ProcImage250 on the same PC
- Long time recording (several hours)
- Camera control by EyeMotion Software

*Region Of Interest

Application area

- Industry
- Sports
- Physics
- Biomechanics
- Medical
- etc.

Application

- Troubleshooting
- Process and quality control
- Defect detection
- Dynamic loop back to high speed events
- Sports Coaching
- Reeducation
- etc.

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Operation modes

- **Standard high speed camera mode:**
  - direct recording to hard drive up to several hours;
  - direct recording of short time video into the internal RAM.

The USB 2.0 interface provides a great flexibility and has the following advantages:
- Simplicity: USB is plug'n play.
- Portability: the camera is powered by USB.
- Multiplicity: multiple cameras can be connected simultaneously on a PC, the limit depending on the number of USB host controllers and the amount of data to be transmitted.

- **Smart high speed camera mode:**
  The ProcImage250 incorporates an FPGA and a SRAM that allow embedded image processing running in real time between two frames, without slowing down the frame rate.

It can be as simple as thresholding, binarization, or more complex such as profilometry, comparison of frame, compression, etc.
It allows:
- the use of smart triggers to take a sequence; and/or
- the use of embedded image processing in order to transmit only useful data in real time.

ProcImage250 offers several ways to record data

Typical Resolution	A[1] fps	B[2] fps	C fps	D fps
640 x 480	126	252	252	252
640 x 240	252	504	504	504
640 x 120	502	1 005	1 005	1 005
640 x 22	2 692	5 385	5 385	5 385
320 x 240	488	976	976	976
160 x 120	1 823	3 647	3 647	3 647
480 x 480	166	332	332	332
256 x 256	563	1 126	1 126	1 126
120 x 120	2 334	4 668	4 668	4 668
32 x 22	38 918	54 054	54 054	54 054

A: Direct recording to hard drive of 8-bit images.
B: Direct recording to hard drive of lossless compressed 8-bit images.
C: Direct recording of 8 bit images, or data from image processing, into the internal RAM of the camera.
D: Direct recording to hard drive or transfer to a program of data from image processing for data rates < 38 MB/s.

On the left :
Maximum fps, for a USB 2.0 transfer rate of at least 38 MB/sec and a write speed to hard disk of at least 38 MB/sec, versus resolution and the way data are recovered.

[1] Due to the transfer speed of USB 2.0 and the hard disk write speed, the maximum number of fps allowed by the sensor can not be reached.

[2] Images containing very noisy areas may put the lossless compression in trouble.

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Standard and smart triggers

**As standard,** it is possible to trigger a sequence 5 different ways:

- from software;
- from a TTL signal;
- from opening or closing manual remote switch;
- from a data packet sent by the network;
- from another ProcImage250.

Optional, you can trigger a sequence by three other ways:

- from a sound taken by the computer's microphone;
- from the crossing of a given gray level by a percentage of pixels in a specific area;
- from exceeding a variation of the average gray level in a specific area.

Other smart triggers are available on request.
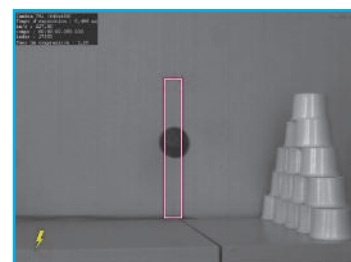
## Embedded image processing (option)

It reduces the amount of data and allows you to transmit only the useful data. It brings numerous benefits:

- operating the sensor at maximum capability, 252 fps at 640 x 480, direct recording to PC;
- connecting multiple ProcImage250 on the same PC without additionnal USB 2.0 card;

- reducing the size of storage data files;
- increasing the acquisition time;
- saving PC computation resources;
- making feedback loops.

Embedded processing available

Name of Image processing	Description	Format - To
Thresholding/Binarization	user adjustable thresholding, and binarization on 1 bit.	1 bit images Direct PC
Profile (surface)	thresholding, binarization, sending useful data to redraw areas above a threshold.	Data Direct PC
Profile (edge)	thresholding, binarization, sending useful data to redraw edges of areas above a threshold.	Data Direct PC
Profile (center)	for laser profilometry application, sending useful data to redraw laser line profile.	Data Direct PC
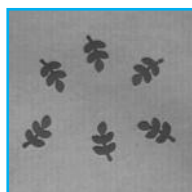
The output datas can be sent to a file, or transferred either through a network interconnection (socket) or through an interconnection between processes (named pipe), to another PC or a program.

Others images processes are available on request like centroid calculations, convolution, negative, etc. When purchasing one of the previous embedded image processes, we also provide others as examples, see p.5.

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Sensor specifications

- sensor: Lupa300
- resolution, Horizontal x Vertical: 640 x 480 pixel
- pixel size: 9.9 x 9.9 µm
- sensor size: 1/2''
- global shutter
- frame rate at full resolution: 252 fps, up to 54 000 fps in lower resolution.
- sensitivity range: 400 – 1000 nm
- 8 bits monochrome

Internal hardware specifications

- motherboard for
  - image processing: image A → image B
  - data analysis: image A → data
  - image understanding: image A → high level description output from image or data
- FPGA Spartan 3 basic S1000 (other possible references, consult us)
- internal memory: 8 MB (48 frames at 640 x 480, 8 bits)
- communication interface: USB 2.0
- configurable input/output: Trigger In/Out, Synchro In/Out, Strobe Out, opto-coupled inputs, TTL max 5 V
- trigger mode: internal, contact closure, TTL (max 5 V)
- other communication interfaces on request to optimize data transfer latency
- option: supply of an HDK (Hardware Developper Kit) with drivers for SRAM, sensor and USB 2.0, example code included. Enables the implementation of embedded proprietary IP in the FPGA.

Mechanical specifications

- camera size: 12.4 x 10.3 x 4.0 cm (w/o connectors, w/o lens)
- camera weight: 420 g
- lens mount: C-mount
- 2 threaded holes for camera tripod, bottom, top
- working temperature: +5°C / +40°C
- 3 BNC connectors for I/O
- 1 mini jack 2.5 mm connector for remote switch trigger
- 1 USB type B connector (power supply and data transfer)
- power consumption < 2.5 W

Block diagram of the camera
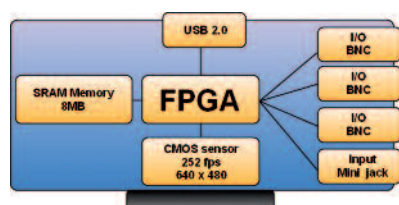
EyeMotion software specifications
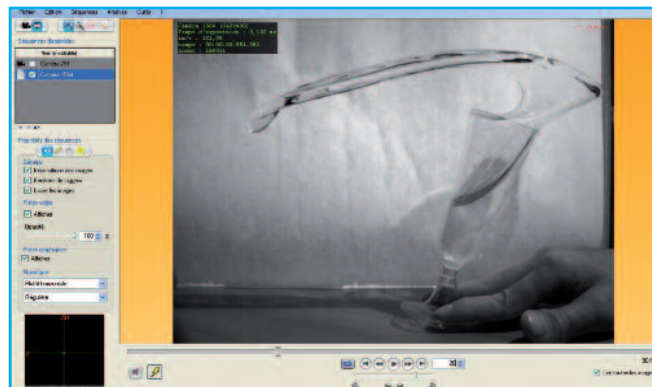
- camcorder function: camera setup, acquisition, save, playback
- save format: .eye, .mov, .avi, .bmp, .tiff, .png, .jpeg
- quick save: .qye
- factory setting ROI* or user adjustable in size and position, 4 x 1 pixel increments
- setting of the HDR** parameters
- histogram display
- Input/Output Manager
- management triggers: hardware, software, sound, UDP (data packet), others ProcImage, others on request
- trigger setup: rising, falling edge, event marker
- trigger position in the sequence: start, stop, frames before or after
- user adjustable display parameters: brightness, contrast, gamma, white point, black point
- simultaneously displaying synchronized videos
- overlay of videos with opacity adjustment
- selection of discontinuous frame ranges
- Windows XP (SP3 required), Vista, 7, 8, compatible
- supports native 32-bit and native 64-bit to handle memory spaces larger than 4 GB
- Software Development Kit (SDK) on request

* ROI: Region Of Interest
** HDR: High Dynamic Range

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Options

- scheduler
  - integrated software tool in EyeMotion to schedule your video captures.

- external cameras
  - management of Webcams compatible with the OpenCV library
  - management of IP camera JVC VN-H37U

- smart triggers
  - from a sound taken by the computer's microphone;
  - from the crossing of a given gray level by a certain percentage of pixels in a specific area;
  - from exceeding a variation of the average gray level in a specific area.

- embedded image processing
  - image processing carried out in real time at high speed in the camera's FPGA
    · Thresholding/Binarization
    · Profile (surface), (edge), (center)
  - freely provided as example when purchasing of embedded image processing:
    · convolution with 3x3 matrix user adjustable;
    · convolution (Roberts) or (Sobel), edges detection by Roberts or Sobel operator.
    · multi centroid

- post-processing (EyeMotion 2D)
  - graphical tools with dynamic overlay of data, text, shapes, images and films for manual tracking and reporting;
  - calculation and export of positions, speeds, accelerations, lengths, angles;
  - automatic recognition of markers, blob type, disc type;
  - user configurable skeleton tracking.

- lens calibration
  - Correction of lens image distortion [1].

[1] Service at the factory and requiring the return of the camera and the lens to calibrate.

Related services

FPGA programming service for development and implementing of custom IP*.
From your images and a description of your image processing needs, our study team can assess the feasibility of your requirement and send you a quote.
* Intellectual Property

Based on the ProcImage250, custom high speed intelligent camera manufacturing.
Contact us.

References order

Reference camera : ProcImage250-8

- All options listed previously can be ordered individually.
- After purchasing the camera, adding an option is possible at any time.
- Graphical tools and EyeMotion2D can be provided as single license per seat.

Items supplied with each camera

- "EyeMotion" software
- camera licence
- high speed USB cable, length 1.8 m (USB type B male – USB type A male)
- remote switch trigger with mini jack connector 2.5 mm
- installation manual

Minimum recommended PC configuration

- hard disk 7200 rpm or SSD
- 2 GB RAM
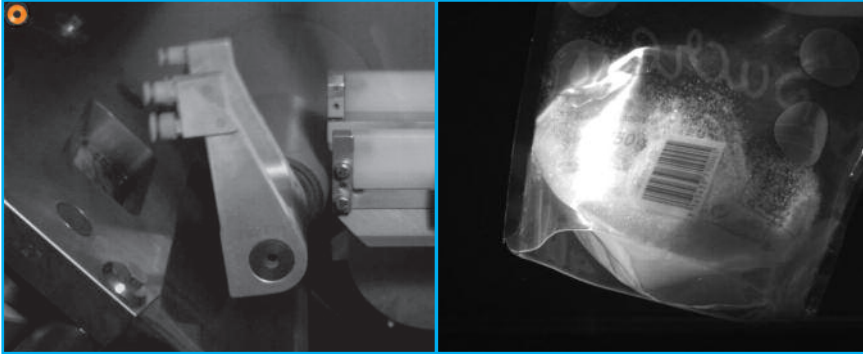- processor 2 GHz
- Windows XP (SP3 required)
- interface USB 2.0

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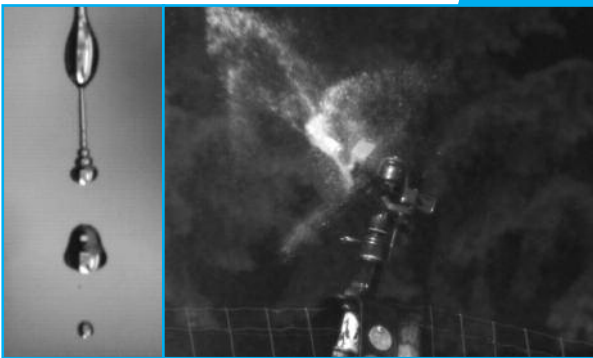**SMART HIGH SPEED CAMERA**

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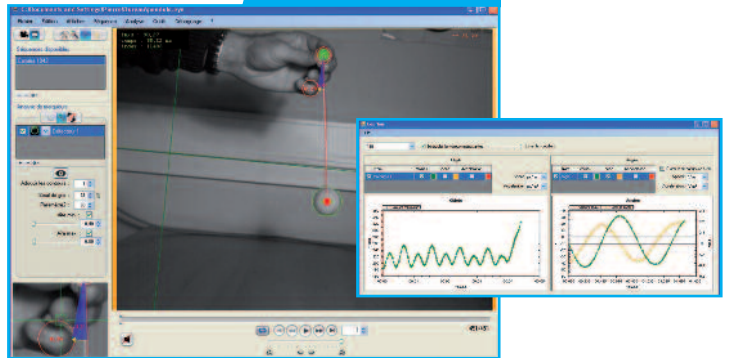
MONOCHROME VERSION

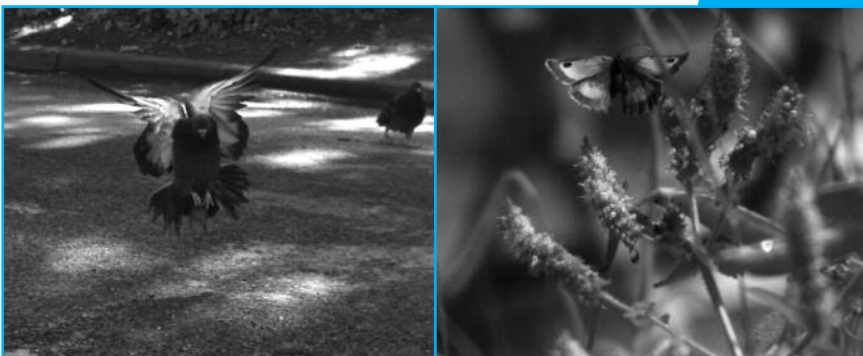**Troubleshooting – Quality control**

Sports

Fluids

Motion analysis

Animals

Graphical tools

See Fast Technologies
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