

AUTOMATION

The camera development of the last years identifies a trend towards compact cameras showing more functionality and therefore more intelligence with the help of programmable components like FPGAs. By the use of USB 2.0 the next generation industrial cameras are easy to use and flexible.

For one year with the USB camera mvBlueFOX Matrix Vision is showing what is possible within the industrial camera compact class. The dimension of the CCD camera version is 38.8 mm width/height and 58.5 mm length. Different sensors are available: progressive scan CCD sensors each as grey scale or color version with resolutions from 640 x 480 (max. frame rate up to 100 Hz) to 1600 x 1200 pixels (16 Hz) as well as cost effective CMOS sensors each as grey scale or color version with a resolution of 1280 x 1024 pixels. The versatility is also existent during the choice of the lens mounts. C-mount, CS-mount and S-mount lenses including back-focus-adjustment as well as customer-specific mounts are supported. Additionally the camera offers two inputs and outputs, which can be used for trigger and flash. Due to random process divergences a sensor manufacturer cannot guarantee, that all pixels of a sensor behave the same during the same light conditions.

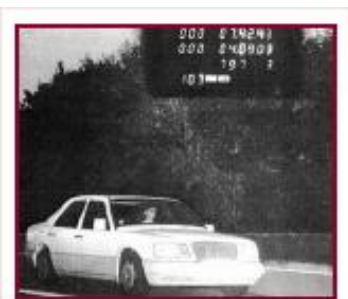


Figure 1 vehicle with reflective license plate



Figure 2 correct image with license plate and driver



USB camera with HRTC

Ulli Lansche, Matrix Vision

These divergences are called defective pixels. Matrix Vision offers the possibility to correct them with the software calculationally. Additionally the sensors are calibrated during the assembly optically with the effect, that Matrix Vision cameras show very small mechanical manufacturing tolerances.

Image processing functions

The camera offers often needed image processing functions like horizontal and vertical mirroring, sharpening and Bayer color conversion, which due to the special integration minimize the PC load. Furthermore using different binning modes the image acquisition can be accelerated or the sensibility of the sensors increased.

The functions automatic exposure control (AEC) and automatic gain control (AGC) offers an additional improvement of the image quality.

New image acquisition possibilities

HRTC is the abbreviation of Hardware Real-Time Controller and is based on the internal FPGA. With the HRTC an application developer is able to create acquire sequences or sequences to control the I/O. In many cases this functionality makes a PLC component needless. An example will demonstrate the advantages of the HRTC. Figure 1 shows an overexposure of a license plate. To prove an administrative offence it is necessary to have a picture of the driver and the

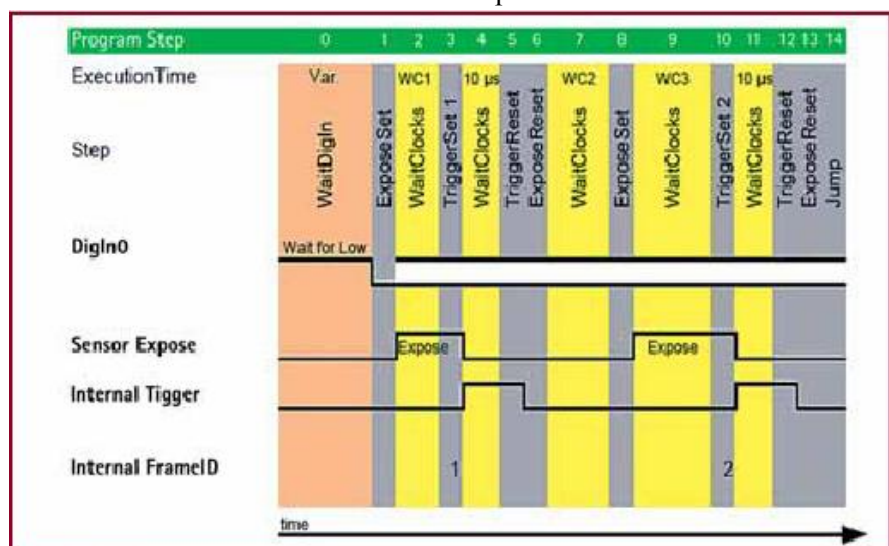


Figure 3 programm sequence for overexposure

OpCode	Parameter	Description
Nop	-	No operation
SetDigout	Operation array on dig out	Set digital output
WaitDigin	State definition array on dig in	Wait for digital input
WaitClocks	Time in μ s	Wait a defined time
Jump	HRTC program address	Jump to any step of the program
TriggerSet	FrameID	Set the internal trigger start
TriggerReset	-	Reset the internal trigger start
ExposeSet	-	Set expose start
ExposeReset	-	Reset expose start
FrameNrReset	-	Set the frame number to 0

Table 1 HRTC function overview and description

license plate. This guideline could be accomplished with a double flash and different exposure times (Figure 2). For this the HRTC offers several functions to solve these kind of tasks (Table 1). Figure 3 demonstrates which steps are necessary to implement a double flash with the HRTC.

The double exposure is only one of several examples how the HRTC can be used. Thinkable are:

- Dark and light image acquisitions to generate a reference image
- Exposure control on images with different wave lengths (R/G/IR)
- Complex trigger (logical link of the inputs)
- Ejector in a predefined time after acquisition
- Pulse width controls
- Synchronisation of several cameras

The camera is also available for OEMs called mvBlueFOX-M. The mvBlueFOX-M is a single board version of the industrial camera.

With 38.8mm width and height and with a depth of 34mm (CCD module version is smaller than the standard version but it offers more features. Contrary to the standard the module version offers four digital inputs and outputs. Drivers for Linux and Windows are available. Furthermore DirectShow, NeuroCheck, Halcon, LabView and MATRIX VISION's image processing library mvIMPACT are completely supported.