ISP
Xilinx FPGA IP

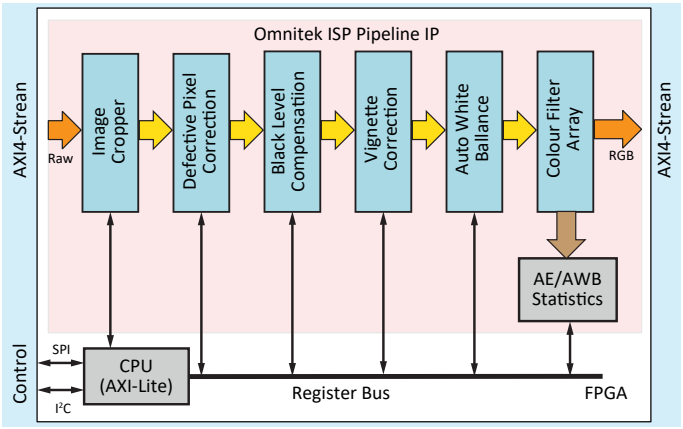
Omnitek

Summary

Omnitek's ISP (Image Signal Processing) IP is designed to provide all the necessary correction tools to take the RAW image from the camera sensor array, interpolate, white balance, colour correct, noise reduce and condition the image prior to transmission or storage.

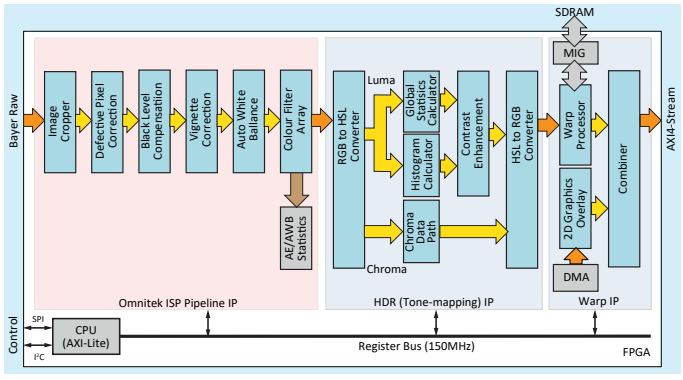
This IP is required to decode the output from a digital camera image sensor and turn it into a viewable image. Typically, the sensor output is not arranged in a conventional RGB raster image format, and instead uses a "Bayer" or similar arrangement of pixels.

Sensors often contain dead or noisy pixels and suffer from uneven lighting and other image quality anomalies that need to be resolved.



Functional block diagram of the ISP Pipeline IP

A typical implementation of the ISP Pipeline IP uses additional IP Cores such as the Omnitek High Dynamic Range (HDR) IP to condition the image and the Omnitek Warp IP to perform lens correction before the image is output.



Typical Implementation of the ISP Pipeline IP

Connectivity

Omnitek provides a large range of complementary IP Cores for video processing and connection. These IP cores can be used individually or in combination to provide FPGA solutions for applications in broadcast, AV, aerospace/defence, medical and automotive industries. Omnitek IP Cores can be supplied as discrete blocks for inclusion in your own designs, as single chip solutions or Omnitek can provide a bespoke solution which can be tailored to your specific needs.

Key Features

- Very small FPGA resource footprint
- Very low latency (as little as 3 video lines)
- Input video format support for 8/10/12-bit Raw Sensor Image
- Image resolutions up to 4096 pixels x 2160 lines up to 120Hz
- Image Cropping
- Defective Pixel Correction
- Black Level Correction
- Auto White Balance
- Vignette correction
- Colour Filter Array Interpolation (for example de-bayer or CFA)
- Focus Assist analysis
- Wide Dynamic Range support
- Bare Metal and Linux Support Libraries
- Available as an independent IP Core
- Fully compatible with Omnitek OSVP, HDR, Warp, Image Stitch and other IP Cores to provide a comprehensive image processing package.

Applications

The ISP IP can be used in a range of applications including:

- Camera image correction
- Automotive image capture
- Medical imaging
- Multiple image stitching

Supported Devices

The ISP IP can be implemented on the following Xilinx devices:

- Artix-7, Kintex-7 and Virtex-7
- Kintex UltraScale and Virtex UltraScale
- Kintex UltraScale+ and Virtex UltraScale+
- Zynq-7000 APSoC and Zynq UltraScale+ MPSoC

Additional Requirements

The ISP IP requires an ARM processor, MicroBlaze or any AXI4-Lite CPU to allow configuration of each IP Block and to take measurements via the Register Bus.

IP Sub Blocks

The ISP pipeline contains multiple processing blocks to turn the sensor output into a high-quality image.

Image Cropper

The Image Cropper block is used to geometrically crop the sensor output to remove unwanted edges.

Defective Pixel Correction

The Defective Pixel Correction block is designed to identify and replace defective pixels by statistical analysis of each pixel and its neighbours.

Raw Image

Corrected Image

Black Level Correction

The Black Level Correction block is designed to remove any offset (or cast) that is present in the Red, Green and Blue components. Typically caused by sensor 'Dark Charge' and other artefacts.

Vignette Correction

The Vignette Correction block, which provides a 32x32 user defined matrix, is designed to remove intensity variations, typically circular in nature, caused by image aperture or zoom.

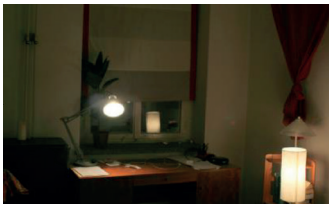
Raw Image

Corrected Image

Auto White Balance

The Auto White Balance block is designed to compensates for the colour distortions caused by the light spectrum differences with respect to the CIE Standard Illuminant D65. This block also performs Auto Exposure.

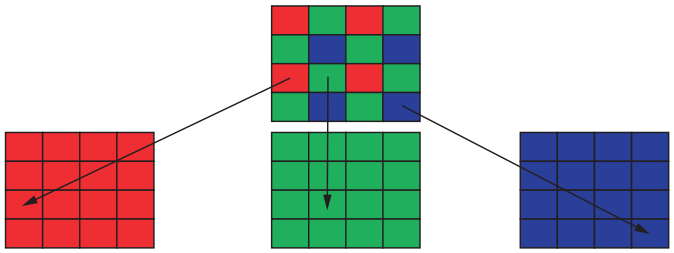
Raw Image



Corrected Image

Colour Filter Array

The Colour Filter Array block is used to de-Bayer the image from the sensor to create a contiguous stream of Red, Green and Blue data.



AE/AWB Statistics feeds back information to the control software to allow the automatic correction of exposure and white balance.

Reference Design

Information not currently available. Please contact Omnitek for more information.

Reference Platform

Information not currently available. Please contact Omnitek for more information.

Omnitek

UK Head Office
Intec 3, Level 1
Wade Road
Basingstoke
Hampshire
RG24 8NE

Tel: +44 (0)1256 345900
Fax: +44 (0)1256 345901

Email: consultancy@omnitek.tv

About Omnitek

Omnitek is a leading independent consultancy company specializing in the design of products and IP for the broadcast, post-production, digital film, AV, medical, aerospace/defence, automotive and consumer industries. Since its foundation, Omnitek has completed many successful design projects for major equipment manufacturers throughout Europe, Asia, and the United States.

Omnitek reserves the right to change specifications without notice. Refer to the Omnitek web site for the latest specifications and further information:

www.omnitek.tv

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