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FPGA-based Image Analyser for Calibration of Stereo Vision Rigs

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On a modern 3D movie set around 6 terabytes of data are captured during each hour of recording (assuming: 4K resolution, 25 FPS, 10 bit Y'UV 4:4:4 data). The costs of single day of shooting are tremendous. These include wages of a large number of skilled technicians, lending various types of equipment, supplying hundreds kilowatts of electrical power, financing the actors and many others. It is hence essential to reduce the time required for preparing the equipment for the particular scene and to ensure that the takes will not be defective due to any technical problems. This could be ensured by a dedicated real-time video streams analyser.

The cameras have to be perfectly aligned to ensure proper acquisition of 3D video sequence that allows the viewer to fully and positively experience the 3D scene. The vertical alignment of the cameras is done with a sub-pixel precision. Fault to do so, could easily cause dizziness to the viewers. To create the 3D effect camera optical axes are slightly shifted apart horizontally and converged, so that the collected pictures differ similarly as when the scene would be observed by human eyes.

The currently used video cameras usually record the video directly to an SSD drive, while at the same time providing a high-quality SDI stream for preview. The Image Analyser captures two of such video streams, from left and right camera of around 3 Gb/s each, and compares them using a set of several predefined algorithms. The Analyser is based upon a recent Kintex-7 FPGA carrier card with a custom designed double-width FMC video interface module (FMC-3DV).

The device offers several methods of the image comparison. It can generate a stereoscopic preview stream for 3D capable monitors. It offers two types of the anaglyph images for observing with glasses with colour filters. It is also capable of simple arithmetic operations like pixel-by-pixel average or difference. Finally, it can compare mean colour values between the two images in several areas. The analysis results are also provided in a form of video stream, which is outputted by means of a HDMI interface in the real-time.

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