FPGA-based Intelligent Video Projection Fusion equipment

Team name:VTeam
School:East China Normal University
Team member:Xiong Wei,Mao Yuyang

This work has designed an intelligent video projection fusion device based on FPGA that can seamlessly fuse display screens of multiple projectors and provide higher resolution. And supports multiple ways of fusion display, suitable for a variety of higher requirements of the application scenarios. This work accelerates video processing from hardware and algorithms level, realizing multi-channel ultra-high-definition video processing in real time, and solving the difficulties of simultaneous input and output of multi-channel 4K resolution video. It also uses a multi-core architecture and parallel mechanisms to achieve efficient processing of video data and achieve video fusion. On this basis, this project can use the camera to capture the image of the projection environment, with algorithm process to eliminate the influence of the environment on the projection effect and achieve the adaptive effect of the intelligent environment.

The hardware of this project is characterized by multiple video processors, multiple FPGAs, multiple ARMs, and multiple DDR3 architectures to achieve real-time processing and fusion of multi-channel Ultra HD video. Multiple FPGAs are used as the core processing. The system uses multiple FPGAs as the core processor, four SiI9616 as the system video processor, one Cortex-M7 core MCU as the system controller, and DDR3 high-speed storage granules to form a RAM resource with a total capacity of 16 Gb. The hardware design includes a complex schematic design and a 12-layer high-speed PCB design. 1866Mbps high-speed DDR3 memory and 10Gbps GTX high-speed communications pose a serious challenge to system signal integrity and power integrity design. Through the combination of multiple boards and utilizing the advantages of FPGA parallel processing, the implementation of video processing algorithm can process dozens of ultra high-definition video at the same time.

The innovation point of this work is:

1. Independent design and development of hardware and software.
2. Multiple video processors, multiple FPGAs, multiple ARMs, multiple DDR3 architectures.
3. Using multiple high-speed data signal designs to improve data communication and processing efficiency from the hardware level.
4. Acquiring environmental information through a camera, intelligently identifying the environment, and implementing self-adaptive environment
5. Support multi-channel 4K ultra-high-definition video parallel processing and multi-board cooperation, multi-channel video input and output expansion.

Figure-1 12 layer selfdesigned board

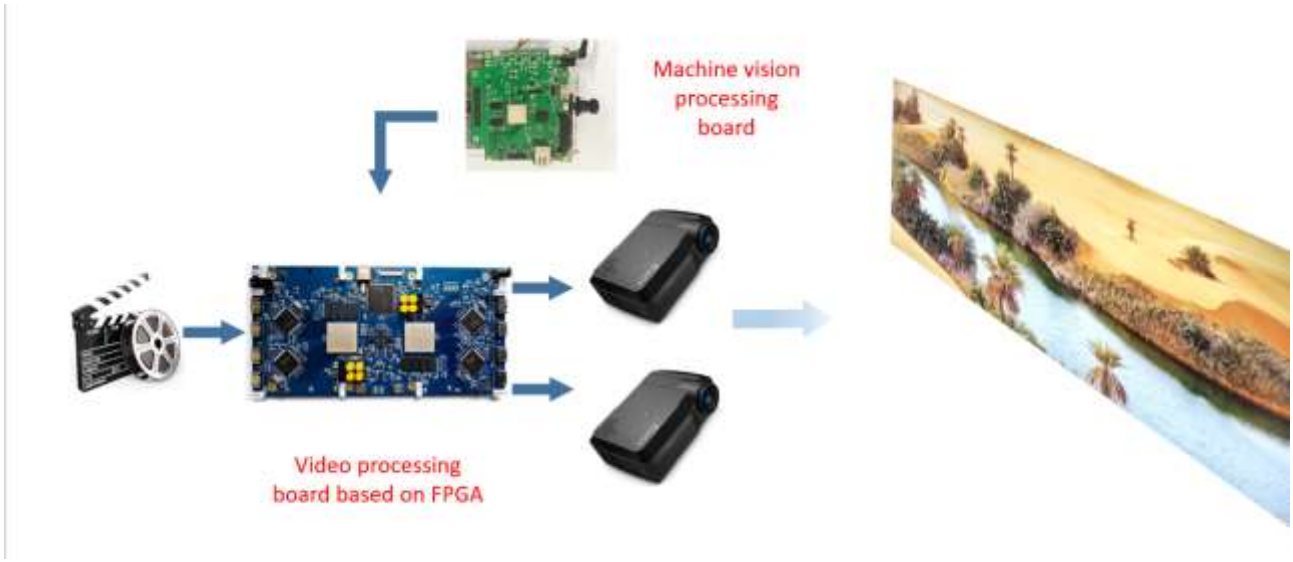

Figure-2 system solution

Figure-3 material object of our system

Figure-4 two channel fusion of left and right

Figure-5 two channel fusion of up and down

Figure-6 multi-channel fusion