An FPGA based low cost frame grabber for video processing

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ABSTRACT- *This paper presents a low-cost frame grabber, which was specifically designed as part of a real-time video processing. The frame grabber is FPGA-based to minimize size of the PCB and improve reliability of the system. It also acts as a backend add-on card for an IBM-PC compatible. The experimental tests carried out on different machines show that the board implemented meets all specifications required by the system, and performs well. The captured frames are clear, well contrasted and jitter-free in both live and still video modes and their quality is comparable to that available from equivalent commercial system.*

***Keywords*— Xilinx embedded development kit (EDK), VHDL, FPGA, Xilinx, Spartan 3E board.**

I: INTRODUCTION

A frame grabber is an electronic device that captures individual, digital still frames from an analog video signal or a digital video stream. It is usually employed as a component of a computer vision system, in which video frames are captured in digital form and then displayed, stored or transmitted in raw or compressed digital form. Historically, frame grabbers were the predominant way to interface cameras to PC's. This has substantially changed in recent years as direct camera connections via USB. Early frame grabbers had only enough memory to acquire (i.e., "grab") and store a single digitized video frame, hence the name.[5]

An FPGA based frame grabber provides low cost and an accurate, flexible system. The chip was designed based on algorithm using VHDL and implemented on an FPGA on Xilinx Spartan 3E board. An FPGA-based system delivers a fast sampling rate with lower power consumption.

Figure.1 Typical high cost frame grabber connected with video camera

The typical frame grabber is shown in fig.1.this frame grabber is easily available in the market at high cost, but it provide low data rate and resolution. And if any one bit change in this frame garbber , than it is necessary to change every thing in it. so this is my source of inspiration to make a something new that is more useful.

An FPGA provide reconfigure so if we want to change any programming in it than we can easily change by writing the code only.

. II: VIDEO PROCESSING SYSTEM

The Epiphan frame grabbers allow the user to capture, record, or broadcast a high resolution and high frame rate VGA display signal using an Epiphan frame grabber with their image capturing computer. [6]

- The Epiphan frame grabbers can also emulate a high-res camera compatible with DirectShow on Windows, QuickTime on Mac OS X, Video4Linux on Linux, Epiphan's software and other third-party applications that support cameras or frame grabbers as a video input source.[6]

this open architecture for epiphan frame grabber devices enables seamless integration with applications such as adobe premiere, final cut, windows video encoder, quicktime and many other 3rd party applications[6]

- the frame grabber is connected to a pc through its isa local-bus as a backend add-on card. during an operation, video pictures from a video camera are captured, and either stored in vram for processing latter or passed to a d/a converter for live display.

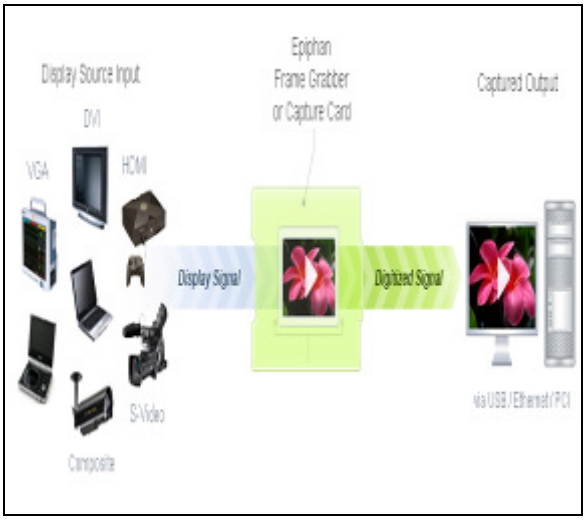

Figure.2 video processing system

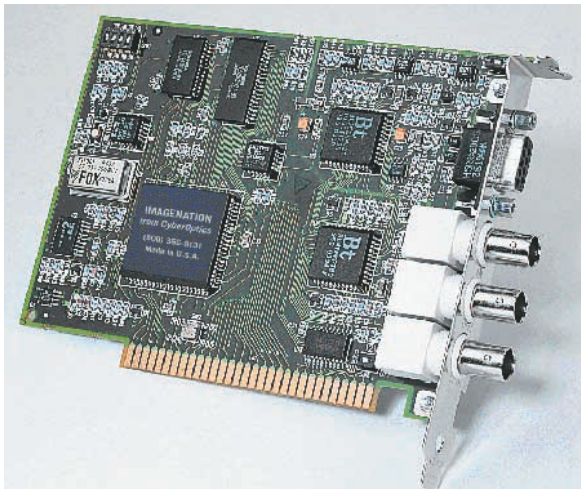

Figure.3 The CX100 frame grabber

The frame grabber is connected to a PC through its ISA local-bus as a backend add-on card. During an operation, video pictures from a video camera are captured, and either stored in VRAM for processing latter or passed to a D/A converter for live display.

III: Imagination frame grabber for computer vision systems:

- The CX100 monochrome frame grabber :

These CX series cards (see Figure 3) are based on the ISA bus configuration and provide 256-gray-level digitization. The CX series has a sampling jitter of plus or minus 3 ns for spatial sampling and a video noise specification of 0.7 of the least significant bit. This family supports both the RS-170 and CCIR video formats with automatic detection and switching and has a triggered input for image capture. The CX100 also includes a loadable lookup table for implementing point-processing functions in hardware.[3]

The CX100 has been the old standby for my research group for years. Its biggest limitation is the low bandwidth (5 Mbytes per second) of the 8-bit ISA bus. When you want to copy a full-resolution image over this bus, frame rates drop to 4 Hz or below. However, using small regions of interest and doing most of the processing on the card can mitigate this problem. In addition, the low-resolution mode is adequate for many applications and significantly increases speed. We have achieved image-processing rates of over 20 Hz for line detection in vehicle guidance using such methods. For non–real-time applications, the slow bus might not be a major factor.[3]

- The PXC200 colour frame grabber:

These cards (see Figure 4) are based on the PCI bus and combine low cost with good monochrome and color image capture. Although the color capture supports only composite sources (NTSC or PAL), this is adequate for many color vision systems. The card supports several pixel formats, including 32-bit RGB, 16-bit YCrCb, and 8-bit grayscale and provides 640 × 480 maximum resolution for NTSC and 768× 576 for PAL. The PXC line has a pixel jitter of plus or minus 4 ns and a stated video noise specification of less than or equal to the least significant bit of intensity level. In addition, several options for scaling and cropping are available on the card, decreasing memory and bus bandwidth requirements. Library functions support a variety of adjustments to the video signal, including contrast, brightness, hue, and saturation changes; gamma correction; luma and chroma control; and adjustable video level. Another nice feature of the software library is support for several cards and process queu- ing, which can reduce delays caused by image grabs.[3]

Using the PCI bus significantly enhances the data transfer capabilities of the PXC200 over its CX predecessor. In testing the PXC200 for full-resolution frame transfer on a 300-MHz PC running Windows 95, I have typically encountered 23 to 24 frames per second, even when running other applications during the test. In practice, we have found that using the single- field-only capture has also markedly increased processing capabilities by reducing the grab time.

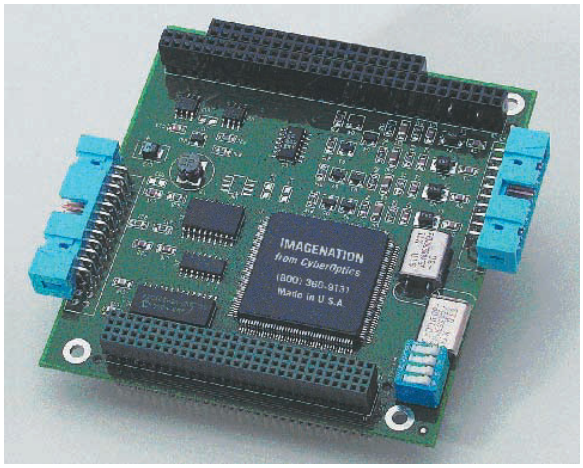

Figure.4 The PXC200 frame grabber

IV: WORKING MODEL

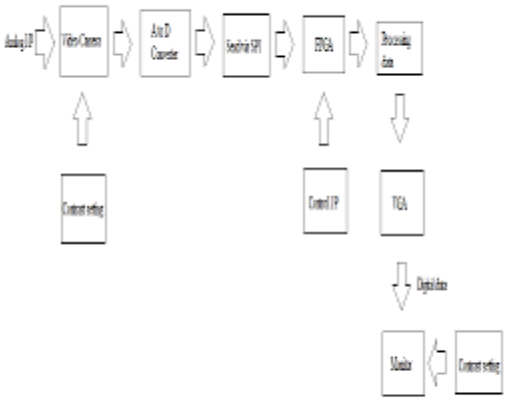

Figure.5 Working model

Working model of the process is shown in fig.5.in this fig. Analog input is applied to the video camera and that analog data is converted into the digital form by using an A to D converter. This data is than send via SPI (serial peripheral interface) and applied to an FPGA for further processing. Than data is given to the VGA (video graphics array) and process on it. After this process we get a digital data and applied to the monitor and we can see the video.

V: CONCLUSION

Existence frame grabber are available at high cost starting from 15,000Rs. But it has slow video rate and resolution.and any change in program causes frame grabber useless. And if any changes in a bit of a program than its need to re-program the circuit.

Thus, I think to make an FPGA based frame grabber in which if any changes made than only program is added or remove as FPGA is reconfigured. And this frame grabber made low cost (8,000 to 10,000 Rs.) compare to the existence frame grabber. and this frame grabber provides high data rate and better resolution compare to the existence frame grabber.

REFRENCE

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