

Spartan-3A DSP MicroBlaze Processor System

Implementing an HD-Video Control Plane Embedded Processing System For Object Detection and Highlighting

Contact: Glenn Steiner

XILINX®

Keywords: Spartan™3A DSP, MicroBlaze™, DSP, Video Starter Kit, VSK, Object Detection, HD Video

Summary:

This demonstration and workshop is an introduction to using the Xilinx MicroBlaze embedded processor for video control plane applications. The Xilinx Video Starter Kit, Spartan 3A DSP Edition is used in the design implementation. In this hands-on workshop you will build a complete streaming video application that includes DVI interfaces, a run-time configurable video filter, a real-time object detection and tracking filter, and a MicroBlaze embedded processor for embedded control of the video subsystem.

The demonstration is also available as a SystemAce file ready for installation on a compact flash card for immediate demonstration of the design.

Figure 1: Object Detection and Highlighting Demonstration, is a screen capture of HD output.

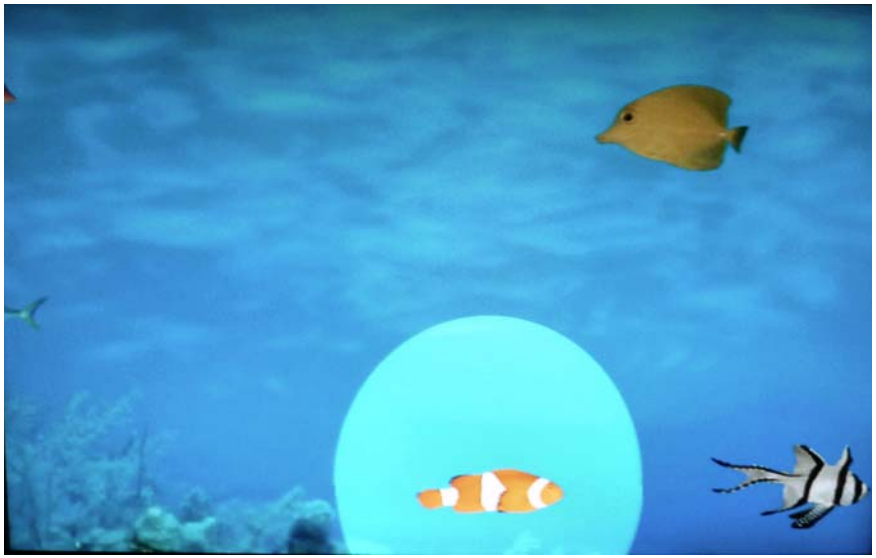


Figure 1: Object Detection and Highlighting Demonstration

Figure 2 illustrates a block diagram of the signal processing system with IP that is used in this implementation. **Figure 3: MicroBlaze Processor System Block Diagram** illustrates a block diagram of the processor system with IP that is used in this implementation.

The completed system will process video data at 720p resolution (1280 by 720 pixels). The filters will analyze the video stream and look for a distinct pattern, for example the stripes of a fish, then produce a moving spotlight effect around the detected target. The components of this streaming video example include:

- MicroBlaze soft processor and related peripherals including a UART for serial communications
- DVI input and output interfaces
- Gamma-in and Gamma-out blocks for color format conversion
- 2D FIR filter block previously developed using Xilinx System Generator™
- Detection and highlighting filter previously generated by a C-to-FPGA compiler

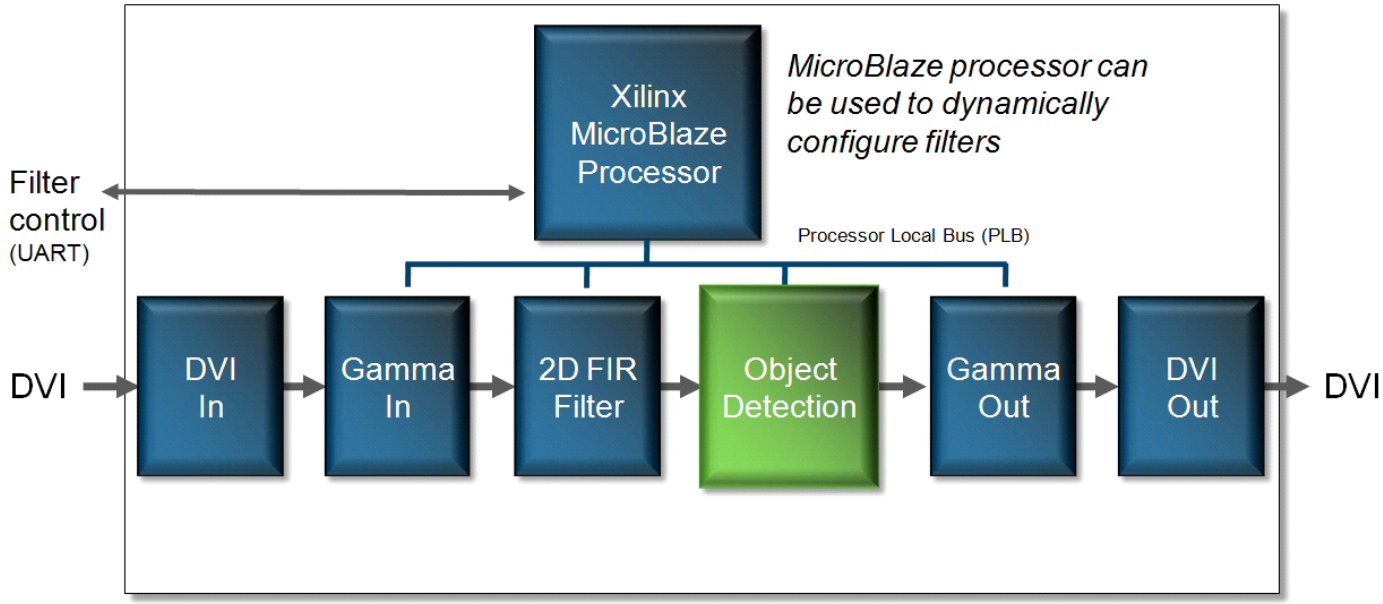


Figure 2: System Level Block Diagram

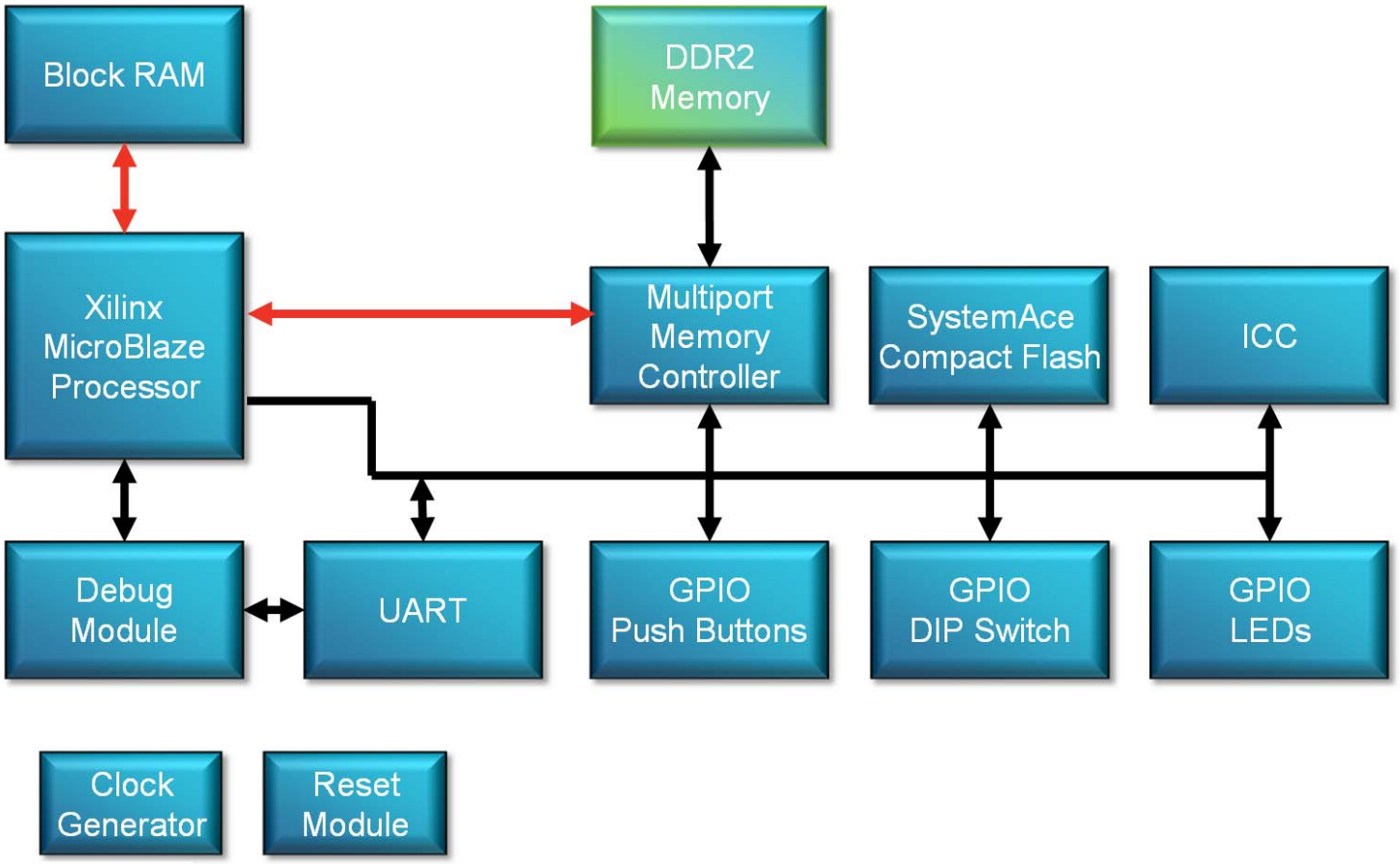


Figure 3: MicroBlaze Processor System Block Diagram

Download Filename:

- MicroBlaze_VSK_FishFinder.zip - Workshop tutorial and design files
- MicroBlaze_VSK_FishFinder_ACE.zip - Completed demonstration as SystemAce file

Requirements:

- Xilinx Video Starter Kit (VSK), Spartan 3A Edition
- DVI-capable video monitor capable of displaying 720p (1280 X 720) resolution
- DVI Video source capable of outputting 720p resolution
    - Design has been tested with DViCO TViX HD M-6500A video player http://www.dvico.com/
- Workstation running Windows XP or Linux
    - This module describes the design running on a Windows XP system
- Xilinx Platform Cable USB for downloading a design
- Serial cable provided with the VSK

Software Requirements

- Xilinx ISE and EDK 11.1i software
- HyperTerminal or similar terminal program running at 9600 baud

Setup and Operation – Workshop:

1. Unzip the zip-file: **MicroBlaze_VSK_FishFinder.zip to C:**
    - This will place the design files in several directories under: c:\xilinx_design\S3A_VSK_Labs\FishFinder\
    - The aquarium video to be played will be placed at: c:\xilinx_design\S3A_VSK_Labs\FishFinder\Aqua1280x720x4.wmv
    - The workshop instructions will be placed at: c:\xilinx_design\S3A_VSK_Labs\FishFinder\ MicroBlaze_VSK_FishFinder_Lab_11.1.pdf
2. Follow the directions in the file: **MicroBlaze_VSK_FishFinder_Lab_11.1.pdf**

Setup and Operation – SystemAce Demonstration:

1. Unzip the zip-file: **MicroBlaze_VSK_FishFinder_ACE.zip**
   a. Copy the file **FishFinder.ace** to a compact flash card formatted to be used with SystemAce.
   b. Copy the video source (Aqua1280x720x4.wmv) to the player, start the video source playing the aquarium video, and set for continuous repeat
2. The VSK board should be configured with factory default settings and power adapter should be connected
3. Connect serial cable to the VSK board and PC
4. Connect a DVI cable between the VSK board DVI output port (located on the main board) and the monitor
5. Connect a DVI cable between the VSK board DVI input port (located on the daughter card) and the DVI video source
6. Install the SystemAce compact flash card and turn on the board power.
7. The file will take a few seconds to download and run.
8. Observe the detection and highlighting of the clown fish.
9. Buttons on the VSK board are read by the MicroBlaze processor and may be used to change the fish detected and the spotlight size:
   - East Button - Find Yellow Fish
   - Center Button - Find Clown Fish
   - West Button - Find Famous Fish
   - North Button - Increase Spotlight
   - South Button - Decrease Spotlight

Additional information about the design may be found in the document contained in the zip file for the full workshop: **MicroBlaze_VSK_FishFinder_Lab_11.1.pdf**

Conclusion:

Using the Xilinx Spartan-3A DSP Video Starter Kit and included reference designs, it is possible to rapidly add custom signal processing modules such as a FIR filter or object detection and highlighting filter to provide a customized solution.

Figure 4: Screen Capture of FIR Filter Output is a sample display when the FIR filter is configured for edge detection.



Figure 4: Screen Capture of FIR Filter Output

References:

Additional information about the Spartan-3A DSP Video Starter Kit may be found at:

www.xilinx.com/vsk_s3

Revision History:

Date	Revision	Comments
5-Jun-09	1.0	Initial release.