Certification and Improvements of MicroTCA Technology Lab’s GigE Vision Stack

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OUTLINE

1. System Overview
2. GigE Vision certification
3. New hardware platforms
4. 10GigE Vision – ready to test
System Overview

Ideas:

• GigE Vision camera interfacing using FPGAs
• High performance image processing
• MicroTCA system integration
• Hardware independent solution
**System Overview**

**FPGA:**
- Camera interfacing
- Image processing
- DMA into on-board memory

**CPU:**
- Run Controller Software (Cmd Server)
- Run Application Software (optional)
GigE Vision certification

- **Step 1**: Formal certification by submitting the GigE Vision Compliancy Matrix
- **Step 2**: Interoperability demonstration during AIA IVSM PlugFest

Step 2 needs some preparation on software side.
Controller Software Improvement

- Implementation of GenICam standard
- Programming interface for industrial cameras

GigE Vision certification

- Implementation of GenICam standard
- Programming interface for industrial cameras
GigE Vision certification

- IVSM from 7th to 11th October in Stresa/Italy
- PlugFest session: 5 passes, 3 “easy to fix” issues (done), 2 interoperability issues from camera side
- Product successfully certified
Hardware Platforms: SIS8160

- **SIS8160 Dual HPC FMC Carrier** together with **DFMC-SFP4**
- Kintex Ultrascale FPGA (XCKU040 or XCKU060 as manufacturing option)
- Supports up to eight cameras
- White Rabbit
- 2x DDR4 interfacing (very useful for multiple camera operations)

From: [https://www.struck.de/sis8160.html](https://www.struck.de/sis8160.html)
Hardware Platforms: KCU105/116

- Xilinx evaluation boards, commercially available
- Multiple purpose boards
- Well documented
- DIPC-7050 Quick Start Guide
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KCU116 Quick Start Guide

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2. Introduction

DIPC-7050 GigE Vision Stack is a high-performance implementation of GigE Vision standard for Zynq 7 Series and FPGAs. Its core technology is based on Xilinx Kintex Ultrascale+ FPGAs. The stack provides basic functionality for GigE Vision adapters, GigE Vision cameras and GigE Vision controllers. This guide provides the steps for installing, configuring, and testing DMIP-7050 Vision stack using the Xilinx Kintex Ultrascale+ FPGAs KCU116 Evaluation Kit. The stack is designed to be extended with custom image-processing logic tailored for user-specific needs.

This guide provides the steps for installing, configuring, and testing DIPC-7050 Vision stack using the Xilinx Kintex Ultrascale+ FPGAs KCU116 Evaluation Kit. To get further information and technical details, please check DIPC-7050 User's and Developer's manual (2) and (3).

3. Required Components

3.1. Hardware

To perform the operations of this guide the following equipment is needed:

- Xilinx Kintex Ultrascale+ FPGA KCU116 Evaluation Kit
- PC (At least 32-bit CPU running Windows 10 32-bit or Linux)
- Xilinx Vivado 2018.2 (or later)
- Ethernet cable (for connecting camera to KCU116)

3.2. Firmware

DIPC-7050 firmware has to be installed on KCU116 board. The firmware realizes attached camera device in interfacing gigabit Ethernet with GigE Vision standard. It also includes an IP core for generating 30 frames per second in parallel. A current version of DIPC-7050 firmware for the usage with Xilinx KCU116 Evaluation Board is provided as a file in the directory /TOP/Firmware.

3.3. Software

To perform the operations of this guide the following software components running on Ubuntu 16.04 LTS or 32-bit Windows are needed:

- DIPC-7050 controller software
- DIPC-7050 Python demo application
- Python 3.6
- OpenCV library for Python
- Xilinx Vivado 2018.2 Edition
- Xilinx XDMA PCIe driver
- Xilinx KCU116 System Controller User Interface (SCUI)

A current version of DIPC-7050 controller software is provided as an executable file in subdirectory /TOP/software/install. The demo application related software part can be found in a set of Python scripts in subdirectory /TOP/software/demo. Assumed here is that the further software components are already downloaded and installed. If this is not the case please refer to Software Installation Instructions in the appendix.

Figure 1: Xilinx Kintex Ultrascale+ FPGA KCU116 Evaluation Kit

DIPC-7050 related firmware and software files are provided in the subdirectories of this guide project folder.
New Hardware Platforms

- ZCU102 – first ZYNQ based standalone solution
- IP cores in PL, software in PS, output with GPU
- First step for porting to DAMC-FMC2ZUP
• Increase throughput, optimize timing
• Under development, first revision “ready for test” till end of the year
10GigE Vision

- Line scan camera observes the production flow on a flat conveyor
- Inspection quality and conveyor speed depend on the image acquisition

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* Maximum framerate of JAI SW-4000T-10GE camera

Conclusion

• DIPC7050 GigE Vision Stack was significantly improved.
• GigE Vision compliant certification process was successfully passed.
• Several hardware platforms are available without putting any effort in the porting.
• 10GigE Vision development is in progress.
• First concrete applications are upcoming soon.
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Thank you!

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Upcoming Events

MTCA Trainings
• Basic Course: 15th – 16th January 2020
• Advanced Course: 26th – 27th February 2020

Exhibitions and Conferences
• Embedded World: 25th – 27th February 2020
• IEEE Real Time Conference : 12th – 17th April 2020

9th MTCA Workshop
• 2nd – 3rd December 2020
• Pre-Workshop: 1st December 2020