FACULTY OF INFORMATION TECHNOLOGY

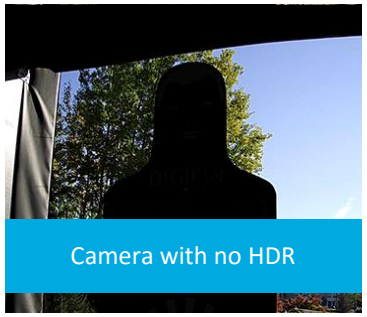
HDR Tone-Mapping Acceleration on Xilinx Zynq Platform

Author: Svetozár Nosko

Supervised by: Ing. Martin Musil

Why HDRi and tone mapping?

- Real world is HDR.
- HDR image has high dynamic range of luminosity (more information).
- Tone Mapping is process of converting values of an image from a high range (10000:1) to a lower one (255:1).
- Tone mapping addresses the problem of contrast reduction from the scene to the displayable range while preserving the image details and color appearance.

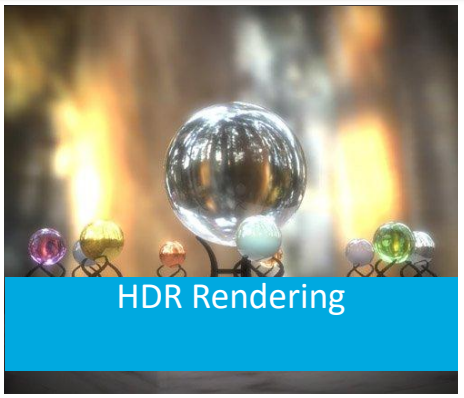


Camera with no HDR

Camera with HDR and tone mapping

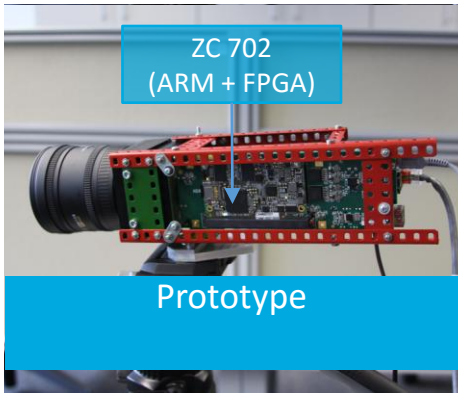
HDR applications

- Computer vision
- Security applications
- Automotive
- Medical rendering
- Industry applications



HDR Rendering

Industry application



Prototype

Proposed solution

- Application is based Xilinx Zynq ZC702 platform using HW-SW codesing.
- Input video is obtained from multi-exposure camera.
- HDR image is created from multiple photos using ARM processor.
- Tone mapping is accelerated in FPGA, beacause it is not possible to get real-time processing using only ARM processor.
- We choosed Durand and Dorsey's local tone mapping operator.
- Based on bilateral filtering using fixed point arithmetic (7x7 kernel).
- FPGA IP Cores implemented using HLS technique (Vivado HLS).
- Pipelined implementation.

Results

- Prepared for real-time tone-mapping in HD resolution at 50 fps.
- On chip power only 2W.
- With camera 6W.
- 22x speed-up compared to implementation on Intel Core I5 6600.