FPGA DESIGN FOR SETRED 3D DISPLAY

12/4/2007

Version 1.1

SUMMARY

The project is intended for students interested in hardware and firmware development, with particular emphasis on FPGA design. The project will involve working with advanced FPGAs and require a student who has a keen interest in FPGA development and programming. Setred has a high competence level in hardware development hence the student will have access to extremely skilled firmware developers with over ten years experience. The student is required to work at Setred's location in Forskningsparken and is expected to work "normal" working hours. The student's schedule might not allow this, but in principle Setred will view the student as an employee. The student will therefore be given all the necessary equipment, follow up and backing that employees receive.

The student accepted for the project will also be given the opportunity to work for Setred during the summer vacation if the candidate is interested. The duration of this internship can be decided by the student depending on his/her vacation plans.

1 BACKGROUND - SETRED

Setred develops a new type of autostereoscopic or 3D display that acts as a digital hologram. It has a unique set of features:

- No headgear or head tracking
- Full resolution
- Large field of view with 3D effect
- Large addressable depth / volume
- Possible to make flat panel



The first product will be up to 20-inch workstation displays, which will be complemented with a 50 - inch display suitable for small conference or collaboration rooms.

1.1 TECHNOLOGY

The system creates the 3D effect by showing different pictures to different locations in front of the display at high speed. It achieves this by combining a high frame rate 2D display with a shutter. The shutter is synchronised with the display and ensures that different portions of the 2D display are visible only from specific locations. The left image below shows how a viewer looking through a narrow slit will see two distinct regions, one for each eye. To create a 3D display from this simple slit system, the slit must shift laterally sufficiently quickly so that a viewer sees the scanning shutter as a transparent window. If all the slits are updated quickly enough to be perceived as flickerfree, a viewer will see the full resolution of the underlying 2D display from any position.

2 PROPOSED PROJECTS

If the student has particular interests the following projects are of interest to Setred and will be considered if the candidate is found to have the necessary skills:

1. Writing firmware to control a Texas Instruments DMD (a high speed micromechanical spatial light modulator). A sample implementation from TI is available, and the first step will be to reproduce this basic functionality. Further steps will include extending the functionality of the controller, integrating it into our existing firmware, and conducting research into novel driving techniques.

2. Implement real time dithering (error diffusion) for a variety of color bit depths. Special dithering algorithms should be developed for the purpose of 3D. A 3D display has different constraints than 2D monitors and it is likely that improved algorithms can be developed specifically for 3D displays.

3. Disparity estimation. Given two images taken from different vantage points a depth map can be constructed using advanced DSP algorithms (typically using fourier transforms etc). Once a depth map has been reconstructed any vantage point, i.e. perspective or view, can be interpolated with a given error. A student working on this project should be comfortable with mathematics.

4. Raytracer. Volume data sets must be rendered in a different way than surface models. A ray tracer in firmware would allow perspectives to be computed from a volume data set. Volume rendering is computationally heavy on PCs and FPGA based rendering would greatly reduce the computational efforts required from the PC.

3 CONTACT DETAILS

The interested student must be prepared for informal interviews. Please contact:

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