Chair for Integrated Systems
TUM Department of Electrical and Computer Engineering
Technical University of Munich

Forschungspraxis

Implementation of an Approximated FIR Filter on FPGA for Laser Line Extraction from Pixel Data

Current 3D laser line scanners have precision in the range of a micrometer. These scanners work on the principle of laser triangulation and use a camera chip in the receive path. The captured pixel data is then processed on an FPGA to generate 3D profile data. In order to do this, the lsaser line, as seen by the camera, must be extracted from the pixel data. For this task, several methods have been proposed. One of these methods employs an FIR filter to calculate the derivative of the incoming pixel stream orthogonally to the laser line direction. Afterwards, the zero crossing of this derivative is detected. The position of the zero crossing marks the position of the laser line in the camera image. From this position, the distance of the laser scanner to the scanned object can be derived.

Approximate computing is an emerging design paradigm that trades in accuracy for resource consumption, i.e. a certain inaccuracy of the calculations is allowed with the goal of reducing the overall resource consumption of the implemented design. In this thesis, such approximation methods should be integrated to the data processing pipeline and the results should be evaluated.

This thesis includes the implementation of a simple data processing pipeline for the extraction of the laser line from pixel data using an FIR filter-based approach. The implementation should be done in VHDL. Furthermore, the necessity for prefiltering (e.g. smoothing) of the pixel data should be assessed and implemented if necessary. Finally, the potential for the integration of approximate computing methods into the data processing pipeline should be evaluated.

Prerequisites

The student should have the following skills in order to successfully complete the thesis.

- Good programming skills in VHDL
- A basic understanding of FIR filter design
- A basic understanding of image processing
- The ability to work independently
- Previous experience with approximate computing is helpful, but not essentially required

The student can work on the thesis remotely from his home office.

Contact

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