

## Improved upgrade processes for Intelligent Sensors of an Ultrasound Computer Tomograph

At KIT a novel imaging method is under development for early breast cancer diagnosis. In this Ultrasound Computer Tomography method (USCT) ultrasound signals are used (A-Scans, ultrasound pressure over time) to reconstruct 3D image volumes of the female breast. For a demonstrator 157 ultrasound transducer array systems (TAS) were designed, built, and packaged as “intelligent sensors”. The individual transducers in the TAS act as receiver or emitter and are round a semispherical measurement container with 25cm diameter . The used transducers have typically a centre frequency of 2.5 MHz and the USCT method uses therefore water as the contact medium.



Fig.1: 3DUSCT II imaging system

### Motivation and challenges

For a upgraded device, called USCT 2.5, a new TAS (transducer array system) design is underway. Part of the new design includes an improved software upgrade handling process of the integrated TI MSP430 microcontrollers. The current upgrade process requires manual plugging of the emulator via JTAG and transferring the program and unique ID per individual of the 157 TAS; a tedious and error prone process. In future, programming and upgrading for all the TAS should be automatized via the I2C bootloader. Additionally, a persistent flash over-writing persistent “production ID” should be introduced per TAS.

### Task

The existing C code must be expanded, define a  $\mu$ C flash layout and process for the already existing test transducers. The new approach should be developed and programmed in a small test setup following good software engineering practices (concurrent version system, test driven development, unit tests). Tests for evaluation should be defined. Then the functionality should deployed and evaluated on the “in process system” currently in a clinical trial in Mannheim and evaluated there too. The successful software deployment should be documented for instance with a thesis report. In the end a final presentation is given to the USCT group and if required to the supervising university.



Fig. 2: Complete and disassembled TAS with PCB and  $\mu$ C

**Tools:** TI  $\mu$ C tool chain, SVN etc

### Required qualifications:

- Good programming knowledge in C
- $\mu$ C and digital and serial bus knowledge (I2C, JTAG)
- basic electrical engineering knowledge

**Duration:** 6 month, Thesis or internship

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