

The Operating System Design for an Electrical Impedance Imaging System

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Abstract

Electrical Impedance Tomography (EIT) images the electrical conductivity and permittivity inside a body from measurements taken from electrodes on the surface. Images are reconstructed using knowledge of the electrode geometry, applied voltage data, and measured current data. Previous studies have reported that the conductivity of breast tumors differs by 4:1 from normal tissues, and the permittivity of the tumors differs by 10:1, suggesting that there is a big contrast between normal and malignant tissues, and EIT might be a promising modality to make up for the limitations of mammography in breast cancer detection.

This thesis reports the operating system developed for a new EIT instrument, the Adaptive Current Tomograph 4 (ACT 4). Its tasks include getting input, displaying output, keeping track of files and directories on the disk, and controlling hardware. Specifically, the ACT4 operating system interfaces with the operators, controls the hardware, manages ACT4 image data, carries out the calibration procedure, incorporates algorithms to reconstruct EIT images, and displays electrical impedance images in static and continuous (real time) mode.

The ACT4 operating system has five major functional modules or blocks, the main interface, Data management, Single Mode Test, Continuous Mode Test and Cell test.

The main interface module converts the EIT data into BMP format and displays it in a multi-panel screen setup. It supports static image display, continuous or real time image display and difference (in time or frequency) image display.

The data management module interfaces with the ACT4 database which keeps records of all the related information of the ACT4 application. The database consists of five tables that contain the subject information, calibration information, excitation information, EIT data and EIT images respectively.

The other three modules (Single Mode Test, Continuous Mode Test and Cell test) deal with ACT4 hardware. They get parameters, excitation information and control setup from

the user interface, transfer them to DSP board, run the DSP code which controls hardware to measure the data, and receive data from the DSP board.

The ACT4 operating system was developed using Visual C++ upon windows XP platform. Its classes are built upon the document-view architecture of the Microsoft Foundation Classes (MFC).