Autonomous Impedance Meter

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Abstract

This bachelor thesis deals with design of a smart embedded device for autonomous measurement of impedance optimized for measurement of biological materials. The goal is to create a device which provides a simple web interface which allows users to capture and further analyze measured data.

The proposed device consists of two subsystems – a digital circuit providing an user interface and an analogue part for measurement. The digital part is based on Linkit Smart 7688 module which is able to run Linux distribution OpenWrt. The module is equipped with MT7688 SoC and offers WiFi capabilities. The analogue part utilizes a single-chip integrated solution AD5933 that is tightly coupled with a custom analogue frontend whose function is to modify the output of AD5933 to avoid a potential damage of biological samples.

The proposed device is able to either measure impedance for a single frequency or perform a frequency sweep across the whole range beginning at 50Hz and ending at 100 kHz. The results are recorded to an embedded SD card and can be easily displayed using web interface. The system supports common two-electrode probes as well as more precise four-electrode probes. The analogue frontend has been simulated using the SPICE simulator to avoid a potential design bug. The experimental evaluation shows that the achieved precision for the typical impedance of biological samples is better than 0.5%.

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