

The Second Place Innovation

Scientific Committee: Electrical and Computer Engineering

Research Work Title

Design and Development of a Real-Time Ultrasound-Guided Electrical Breast Mass Detection System



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Abstract:

Borderline breast diseases (BBD) refer to a group of breast lesions that can lead to diagnostic uncertainty in sampling. These masses may be associated with malignant tumors, making accurate diagnosis of them highly important. In pathological guidelines, it is strongly recommended that these masses be removed from the body. However, in ultrasound evaluation, they may be overlooked as BI-RADS 3, and if more sensitive equipment is not available, biopsies may not be recommended for them. This situation can lead to a delayed diagnosis of potentially dangerous and premalignant masses. These masses are primarily observed in younger patients with dense glandular tissue, which makes mammographic evaluations challenging and is associated with a high rate of false-negative results. Early diagnosis of these masses is particularly important for patients with a family history of breast cancer or for women who plan to become pregnant. The Impedimetric Tumor Detection System (ITDS) is designed based on electrical impedance spectroscopy and can distinguish benign tissues from premalignant or malignant ones. The electrical impedance of biological tissues under alternating electrical stimulation is related to their composition and structure. The system is capable of detecting BBD during breast radiology and is currently awaiting final approval, following testing on 20 animal tumor biopsies and 313 in vitro human biopsies. The sensitivity, specificity, and accuracy of this device have been measured at 95.6%, 89.1%, and 93.5%, respectively.

