

Theme 2-3: Medical Imaging and Bio-Informatics - 2023

Title	Name of the PI	List the Names of the Co-Is	Department	Abstract	Starting Date	Ending Date	Funding	Amount of Funding
Wearable Microwave Tomography System for Bone Health Monitoring	Amer Zakaria	Nasser Qaddoumi	ELE	<p>Within the United Arab Emirates society, bone-related diseases such as osteoporosis are on the rise. This is the result of various factors such as an aging population, genetics, low activity, and an unbalanced diet. In such diseases, the bones' mineral density (BMD) deteriorates as the body's ability to absorb calcium decreases. This is usually linked to Vitamin D deficiency; therefore, possible treatments involve introducing this vitamin to a patient's diet. In order to assess the efficacy of the treatments, currently, the gold standards for BMD diagnosis are dual-energy X-ray absorptiometry and quantitative computed tomography. In these systems, examinations are done for structures in the body, such as the hip and the wrist. A major drawback here is the excessive use of ionizing X-ray radiation, which is harmful for long-term treatments. An emerging alternative modality for BMD assessment is microwave tomography (MWT). In MWT, the human organ is illuminated with various sources of non-ionizing low-power electromagnetic waves, with the reflected signals measured at receivers surrounding the organ. Using optimization techniques, the measurements are processed to create colormaps of the electrical properties of the organ. Within the scope of the proposed research, the organ is the human leg, with the objective being to locate and estimate the electrical properties of the bones. Current research shows that there is a high correlation between the bones' electrical properties and their mineral density. Furthermore, recent research work done by the principal investigators affirmed through extensive numerical studies that MWT is capable of measuring variations in bone properties, enabling it to track bone density changes. In this proposal, the objective is to design and implement a wearable microwave tomography system for bone health monitoring. The design of the proposed system involves designing the transducers, implementing electronic circuitry, and creating human leg phantoms. The transducers and electronics, along with available instruments, are the hardware of the MWT system. The human leg phantoms will be used to test and validate the system's capabilities. Upon completion of the project, the ultimate goal is to reach out to stakeholders in the local medical sector to move towards clinical trials of the system.</p>	01/06/2020	31/05/2023	FRG	351500