# A Novel Flexible Electro-textile 3T MRI RF Coil Array for Stroke Prevention: Design, Characterization and Prototyping

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In the United States stroke happens around every 40 seconds. Stroke is the No. 5 cause of death in the U.S., killing nearly 130,000 people a year (128,978). That is one in every 20 deaths. Among these stroke cases, one out of four is related to carotid artery diseases. Magnetic Resonance Imaging (MRI) is one of the most powerful imaging modality in clinics and is essential for the diagnosis of strokes through carotid artery imaging.

The fundamental limiting factor for high quality MR imaging is the Signal to Noise Ratio (SNR) performance of the Radio Frequency (RF) coils. The current RF surface coils, however, are made of rigid materials. As a result, their SNR is limited because they can not be placed very close to the imaging area thus receiving noises from parts of the human body that are not intended to be imaged. The SNR of surface RF coils is very sensitive to the placement of the coil relative to the imaging tissue. When the coil is placed near the imaging tissue, an increase in signal sensitivity is expected.

The proposed RF coil array system provides an ergonomic and high performance solution to the 3T MRI systems. Taking advantage of the computerized embroidery technology, in this work, we utilize electro-textile to design, fabricate and measure multi-layer RF coil array system for 3T MRI to improve the SNR performance. The RF coil system operates at 127.7 MHz determined by the static magnetic field of 3T MRI system. The contributions and novelties of this work are embodied in five main components: a) RF coil element optimized at the required resonant frequency and input impedance matching to 50 Ω, with and without incorporating active tuning, b) the detailed simulation of the RF coil element performance near human body, in different bending scenarios and its sensitivity to different parameters, c) the prediction of the electro-textile pattern effective conductivity around 127.7 MHz based on a microstrip line measurement method, d) A multi-layer structure electro-textile RF coil array with low mutual coupling and accurate resonant frequency e) the system integration roadmap of the electro-textile RF coil array with the 3T MRI scanners.