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A smart wearable textile array system for biomedical telemetry applications

Abstract

A smart wearable textile array system (SWTAS) with direction of arrival (DoA) estimation and beamforming is proposed and developed for biomedical telemetry applications. This conformal system enables effective and continuous patient monitoring when combined with one or more health sensors, as information about the subject's health condition is received adaptively to guarantee link reliability. This operation is facilitated by a receiver front-end and a digital baseband beamforming network, which enables scalability and flexibility. The proposed SWTAS also features flexible antenna arrays made using textiles, which are arbitrarily located on a cylindrically shaped body phantom to ensure wide spatial DoA estimation capability. Besides being designed to suit on-body placement, the system performance is also characterized for on-body usage using a commercial body-emulating liquid, and placed at a realistic distance from the body, considering user clothing. Investigation indicated a good performance in the system's 80° forward plane with a DoA accuracy of 3°. Finally, a practical evaluation is presented using two transmitters placed at distinct locations and distances. The system successfully estimated both DoAs and received the telemetry signals using beamforming.

Keywords

Antenna arrays; Biomedical communication; Biomedical monitoring; Biomedical telemetry; Conformal antennas; Direction of arrival (DoA) estimation; Smart antennas