Frontal Imaging of a Human Using Two Microstrip Leaky Wave Antennas

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Sensing of humans using radar is a topic of current interest. Range-azimuth tracking of one or more human subjects in a scene has been widely studied. The frontal imaging of a human, which can provide more detailed information on the human being imaged, has received relatively less attention. Previously, the frontal imaging of a human was explored by using a three-element interferometric system and a Doppler radar (A. Lin and H. Ling, *Electronic Lett.*, 660-661, 2006). Three antennas were placed in an L-shape to derive the elevation and azimuth bearings using interferometry, after the various body parts were first resolved in the Doppler domain. A blurry image could be obtained under highly idealized conditions, but the result was not robust.

In order to reliably generate the frontal image of a human, a two-dimensional physical aperture is required. Synthetic aperture is not feasible due to the time-varying nature of human movements. However, the high cost and complexity of realizing a full two-dimensional aperture are undesirable. In this work, we investigate a simple, low-cost concept to achieve the frontal image of a human by using the frequency-scanned beam of a microstrip leaky wave antenna (LWA). The various body parts of a moving human are resolved through the combination of the antenna beamwidth in the elevation dimension and Doppler processing. Two such microstrip LWAs are then placed in parallel to serve as an interferometer to derive the azimuth bearings of the body parts.

This concept is simulated by combining the antenna design with a radar simulator capable of simulating the dynamic motions of a human (S. S. Ram and H. Ling, *IEEE Radar Conf.*, 2008). In the simulation, different human body parts are modeled with ellipsoids and individual scattering contributions are summed to generate the received radar signal. Different antenna designs, radar waveforms and processing algorithms are studied using the simulator to refine the frontal imaging performance. It is shown that the frontal image of a walking human can be obtained using the proposed concept.