Vital Signs Based Biometric Authentication and Health Monitoring Using a mmWave Radar

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Radio sensing, a technology that employs electromagnetic waves, offers a non-intrusive method to gather data about objects without direct contact. This project aims to explore the potential of employing vital-sign-based biometric authentication and health monitoring using an off-the-shelf mmWave Radar, specifically the TI AWR1843 model. This extensive, multi-year study traverses the domains of security and smart health and unfolds in two primary phases. Initially, it focuses on contactless identifying and authenticating individuals, followed by the extraction of vital biometric markers such as heartbeat and breathing rates and patterns for health monitoring purposes. The core hypothesis of this research is that the reflected radio waves, bearing distinct information pertaining to an individual's unique biological characteristics (like the rhythm and pattern of heartbeats and breathing), when captured and analyzed, can facilitate accurate biometric authentication and effective health monitoring. Here, the individual's inherent biological traits represent the independent variable, while the dependent variables encompass various extrinsic factors such as the radio environment's dynamics (including room layout and structure, presence of physical objects near the subject, bodily movements, and aspects concerning radio transmission like power, directivity, and noise). Results have shown that, while successful authentication only takes a few seconds, it is necessary to collect sufficient feature data for health monitoring purpose to train the machine learning model to recognize different health conditions.