

ETSNS0001 - Flexible and Secure Data Transmission System based on Semi-Tensor Compressive Sensing in Wireless Body Area Networks

Abstract

Wireless body area networks (WBANs) collect some physiological parameters of the human body. Each sensor uses limited energy to maximize its own life. There are three crucial problems including adaptiveness, energy and security in WBANs. In order to solve these problems, a flexible and secure data transmission system is proposed in this paper. The proposed scheme is composed of semi-tensor compressive sensing, hash function, Arnold scrambling and chaotic scrambling (SC-HAC). For the adaptiveness problem, our scheme uses semi-tensor compressive sensing to encrypt multiple signals with different dimensions. The chaotic sequence is applied to generate the semitensor measurement matrix. On the one hand, we only transmit a few chaotic parameters, which reduces the number of data storage and transmission. On the other hand, the size of the measurement matrix is small, and the computation overhead can be reduced. The security is considered by the proposed scheme which combines Arnold scrambling and Logistic scrambling to improve the encryption effect. Numerical simulations and security analyses are given to show that our scheme performs well. The total key space is approximately 2^{420} . The absolute value of adjacent pixel correlation is less than 0.004. Traditional compressive sensing method stores 524288 bytes, while the proposed scheme only stores 2048 bytes. When the compression ratio (CR) is less than 0.7, the peak signal to noise ratio (PSNR) of our scheme is obviously higher than those of other three schemes.

Index Terms wireless body area networks, semi-tensor compressive sensing, low-power consumption, security, image reconstruction.

