A Study on Cross-layer Performance Evaluation of Wireless Body Area Network Utilizing Super Orthogonal Convolutional Code

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The Internet of Medical Things (IoMT) shows new physical and temporal challenges for the application of the Internet of Things (IoT) paradigm in the medical field for devices that do not have an established network, such as smart appliances and smart cities [1]. Then, one of the key technologies for configuring the IoMT is wireless body area network (WBAN) technology [2]. In addition, ultra-wideband (UWB) may be a wireless communication technology suitable for the IoMT and WBANs [3]. Our previous research presented a performance evaluation in terms of the transmission failure ratio and energy efficiency for the UWB physical layer of IEEE 802.15.6 under the application of a super-orthogonal convolutional code (SOCC) [4]. [4] confirmed the higher dependability obtained by concatenating an SOCC and a Reed–Solomon code under additive white Gaussian noise and the wearable WBAN channel model. Furthermore, another previous study applied the dynamic channel model to a WBAN under the assumption of a UWB physical layer [5]. The numerical results showed the maximum number of retransmissions required to achieve the desired transmission failure ratio for each link type and the corresponding energy efficiency and average number of retransmissions. However, those our previous researches only focused on a performance in the physical layer. This research examines a cross-layer performance evaluation of the physical layer and the medium access control layer in a WBAN utilizing an SOCC as shown in Figure 1. Numerical results show a network performance can be improved by appropriately determining the SOCC coding rate according to the link type.

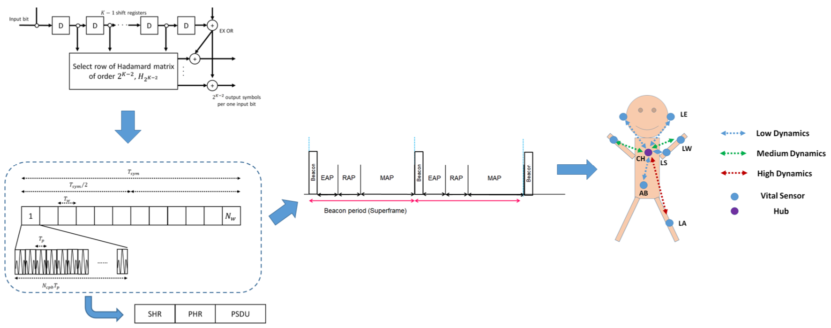

Figure 1. System model: SOCC encoding, physical layer packet configuration, MAC super-frame and WBAN configuration.

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