

V. G. Dronenko, Yu. Yu. Ivanov, S. G. Krivogubchenko (Vinnytsia)

TELEMEDICINE SYSTEM WITH WIRELESS BODY AREA SENSOR NETWORKS AND COMMUNICATION UNIT WITH TURBO-CODEC

The evolution of science and technics has allowed to create a promising application of wireless sensor networks, that is called wireless body area sensor networks (WBAN). It has a huge potential for the revolutionary transformation of medical technologies. WBAN can be used to provide assistance to automatic medical treatment, automatic dosing, and vital signal monitoring. WBAN can provide a healthcare service in a more comfortable, convenient and economical way, than other conventional methods. WBAN provide the ability to broadcast multiple vital parameters in “online” mode, that provides an indispensable aid for people, who suffer from chronic diseases and acute attacks, allowing to react to the worsening of the disease. Also this technology can be integrated into the telemedicine system, that provides unobtrusive ambulatory monitoring and medical information exchange between professionals in order to improve the treatment quality of the patients. WBAN technical implementation is as follows: the special sensors are fixed on the certain organs and transmit statistical data via wireless protocol to different devices, that display detailed information about the patient's condition. The controlling action is produced on the results of processing the information. A sensor node consist of data sensing, data processing and communicating components. Due to the application area WBANs do not require very large network sizes, but must meet the safety requirements and be friendly on the biological parameters, because the work environment is associated with the human body. WBANs are intended for transmission over short distances, but with the higher data rate via communication channels. So, the extremely low power and high reliability requirements of WBANs make the communication challenge. The research of the communication unit in WBAN is an **actual task**, because the requirements induce a need of a good error-correction code in the channel coding scheme.

Task formulation. The work objective is an experimental research of the turbo-code work effectiveness in telemedicine system with WBANs.

For **simulation** the work of the digital communication unit in WBAN we use BPSK modem and turbo-codec with two identical RSC encoders with $m = 2$ tail bits for termination the first encoder and polynomial code generator $g = (7, 5)_8$; code rate $R = 1/3$; random interleaver with Park-Miller random generator; PL-log-MAP decoding algorithm ($Q = 1, 4, 8$ iterations); additive white Gaussian noise channel with Ziggurat algorithm; the energy per bit to noise power spectral density ratio $E_b/N_0 = 1$ dB. The result of the system testing (transmitting computer image “lena.jpg” with 768 frames and 4096 bits per frame) is presented in Fig. 1, where BEN and SEN are the number of bit and symbol errors respectively [1].

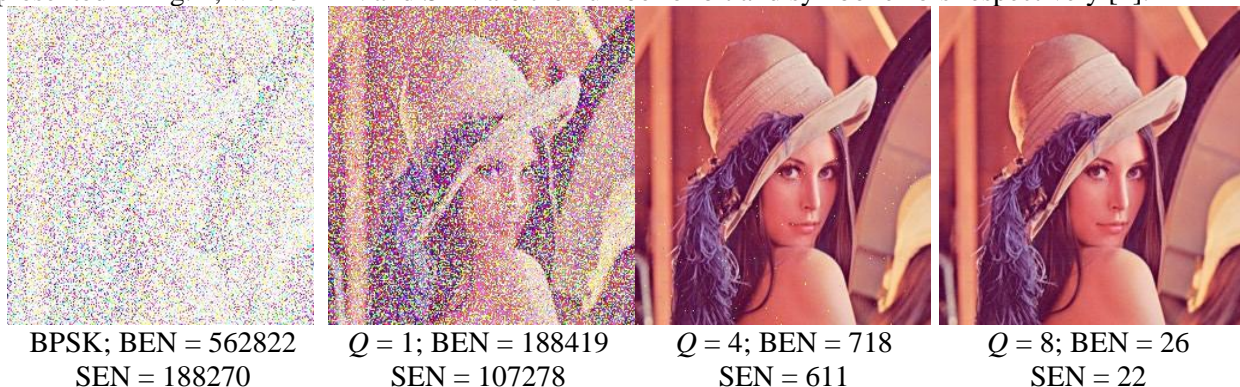


Figure 1 – Results of the simulation

Conclusions. The results of the simulation showed high efficiency of the turbo-code. The PL-log-MAP algorithm has very good performance to use it as a main algorithm for turbo-decoder in the telemedicine system with WBAN communication unit.

References

1. Stukach O.V. A Brief Overview and Experimental Researches of Novel PL-log-MAP Turbo Decoding Algorithm / O.V. Stukach, A.N. Romanyuk, Yu.Yu. Ivanov // Proceedings on XIII IEEE International Siberian Conference on Control and Communications. – Astana, 29-30 June, 2017. – Access mode: <https://ieeexplore.ieee.org/document/7998595/>.