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ELECTROPHYSIOLOGICAL METHODS TO ASSESS PSYCHO-EMOTIONAL STATE OF A PERSON BASED ON MEDICAL NANOSENSORS

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Psycho-emotional state is a special form of a human psychical state with the dominance of emotional responses. Emotional displays are essential to response to real-life situations, because they regulate health and functional state of the body [1]. Electrophysiological methods enable to investigate electrophysiological parameters reflecting psycho-emotional state of a person. Electrocardiography (ECG), electromyography (EMG), electroencephalography (EEG), electrooculography (EOG), and galvanic skin response (GSR) are basic methods that allow recording muscles stimulation, palpitation, the blood outflow from the skin surface, brain activity, etc.

ECG is a method for recording potential differences in the heart's electric field occurring during the heart activity. The averaging of all vectors of action potential occurring at a certain moment of the heart's activity influences the ECG results. The deflections from the normal ECG shape can be found in one or more leads, and this greatly helps to diagnose the heart failure.

EEG is a method focused on brain research using the recording of the electrical potential differences arising during the brain activity. EEG characterizes some states of a person (calmness, stress, excitement) because different brain parts respond to different emotional state [2].

GSR is a sensitive indicator of emotional state. It is determined by the changes in the bioelectric parameters of the hand skin (potential differences and impedance). GSR is caused by vibrations of pre-secretory sweat gland activity controlled by the central nervous system. The factors of emotional and mental activity primarily influence GSR.

EMG is a method of bioelectric potentials research arising in skeletal muscles in the excitation of muscle fibers, recording the electrical activity of muscular. EMG recording allows revealing the intention to start movement a few seconds before the movement. Moreover, myogram serves as an indicator of muscular tension.

EOG is a graphical recording of potential differences arising from changes in the eye movements. The anterior pole of a human eyeball is electrically positive, and the back one is negative, therefore, there is a potential difference between the bottom and cornea of the eye, which can be measured.

The improvement of resolution means that to assess psycho-emotional state of a person is currently very important. The Institute of Nondestructive Testing, Tomsk Polytechnic University, is going to develop medical nanosensors to pick-up biopotentials with higher stability of electric potential, stable contact and polarization potentials, and lower interference and impedance. The existing methods of psycho-emotional state assessment combining subjective and objective testing methods are to be used in examining patients.

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