Proceedings of the 2025 International Conference on Systems and Technologies of the Digital HealthCare (STDH – 2025)

2 – 6 June, 2025
Saint-Petersburg, Russia

ISBN 979-8-3315-9739-9

Proceedings
of the 2025 International Conference on Systems and Technologies of the Digital HealthCare
(STDH – 2025)

June 2-6, 2025

Saint Petersburg, Russia
2025

Preface

The IEEE Russia North West Section and Saint Petersburg Electrotechnical University “LETI” (SPbETU “LETI”) are pleased to present the Proceedings of the 2025 Conference on Systems and Technologies of the Digital HealthCare (STDH). The Conference took take place in Saint Petersburg, Russia, at the premises of Saint Petersburg Electrotechnical University “LETI”.

The conference covered a broad area of research and development of systems and technologies for the digital healthcare. It was targeted on results of research and development carried out by researchers and engineers from both academia and industry.

Conference Chair:
Prof. Alexandr Semenov, Saint Petersburg Electrotechnical University “LETI” (Russia)

Conference Technical Program Committee Chair:
Prof. Zafar Yuldashev, St. Petersburg Electrotechnical University “LETI” (Russia)

Copyright
Copyright for all refereed papers published in the Proceedings is owned by the IEEE.

Publishing Details
Proceedings Edited by S. Shaposhnikov, 2025, St. Petersburg, Russia: Saint Petersburg Electrotechnical University “LETI”
Prof. Popov str. 5, Saint Petersburg, 197376, Russia
Telephone: +7 812 234 28 91
Fax: +7 812 234 28 91

ISBN 979-8-3315-9739-9. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form by any means, electronic or otherwise, without the written permission of the IEEE.

979-8-3315-9739-9/25/$31.00 ©2025 IEEE

Section 1
Methods for Processing and Analyzing Biomedical Signals, Data and Images

Peculiarities of Evaluation of Indicators in the "Health" System Based on the Diffusion Equation

Oleg N. Bodin
Department of Biomedical engineering
Penza State Technological University
Penza, Russia
email: bodin_o@inbox.ru

Oksana E. Bezborodova
Department of Technosphere safety
Penza state University
Penza, Russia
email: oxana243@yandex.ru

Vasily M. Zhigachev
Department of Biomedical engineering
Penza State Technological University
Penza, Russia
email: zhigachevvm@mail.ru

Kristina D. Mishina
Department of Technosphere safety
Penza state University
Penza, Russia
email: kristina_mishina_1998@mail.ru

Dmitry V. Martinov
Department of Technical Quality Management
Penza State Technological University
Penza, Russia
email: dimka.martinov.95@gmail.com

Aleksey A. Trofimov
Department of Information-measuring equipment and metrology
Penza State University
Penza, Russia
email: alex.t1978@mail.ru

***Abstract* – The article presents the results of the development of a method for assessing the level of patient's health taking into account Fick's first law (diffusion equation) and the telemedicine system implementing it. The distinctive features of the proposed method and telemedicine system are the use of zoning of the territory of residence depending on the quality of the environment and determination on its basis of the diffusion coefficient characterizing the dynamism of changes in the controlled parameters. And also, operative control of controlled parameters on the basis of analysis of mismatch of planned and actual values of controlled parameters.**

Keywords – telemedicine, population health, health factors, health indicators, diffusion equation.

I. Introduction

In the strategic documents of the Russian Federation [1, 2] the preservation of public health is noted as a strategic task.

The development of health care and the promotion of public health is the most important area of national security, for the realisation of which a long-term state policy is being pursued, ensuring the solution of the following tasks:

– creating conditions for improving the accessibility and quality of medical care;

– disease prevention;

– ensuring environmental safety.

The development and implementation of telemedicine systems (TMS) is one of the areas of digital transformation of medicine. TMCs form a digital ecosystem for collecting, processing and utilizing data for:

– improving the quality of health care delivery and the development of scientific medical research,

– monitoring and analysing the use of health system resources and the provision of medical care to patients.

The aim of the work is to create a system of assessment and control over the health of the population, including taking into account the impact of the environmental situation in the zone of his residence.

The results of the evaluation are intended to be used to:

– zoning of the territory according to the level of health of the population;

– when undesirable trends are identified and the elements of health corresponding to low levels are defined, it is reasonable to form lists of recommended therapeutic and preventive measures (TPM), the implementation of which will improve the level of health both for a specific element of the health system and in general;

– to develop a plan to conduct control studies for individual patients (groups of patients) in order to evaluate and improve the effectiveness of the implemented TPM.

II. Materials And Methods

A. «Health» system

The authors developed on the basis of [3] TMS "Health", the block diagram of which is shown in Fig. 1. The proposed system can be used to assess the level of human health; planned and operational control of the level of human health by a set of factors, taking into account the environment and society, affecting the person, and indicators reflecting human activity, in order to timely respond to possible changes; justified formation of the list of TPM; other purposes of sanitary and epidemiological supervision.

The proposed TMS consists of a telemedicine centre (TMC) connected via the Internet or radio links to a network of telemedicine points (TMP).

Each TMP includes several telemedicine stations specialized for their purpose. These can be specialized stations of telepathology, telesurgery, telerengenology, teledermatology, telepsychiatry, telecardiology, telegynaecology, teleurology, telepediatrics, telemammography, teleneurology, teleoncology, teleotolaryngology and others. At these stations, patients are examined, medical data are collected, accumulated and primary processed, and transmitted via communication channels to the TMC for processing and further use.

For the purposes stated by the authors, TMPs collect aggregate data on each element of the "Health" system (EHS): health indicators: "disease or developmental defect", "physical development", "physiological reserves", "non-specific resistance", "health motivation" and health factors: "heredity", "lifestyle", "external environment", "culture of social relations", "health care".

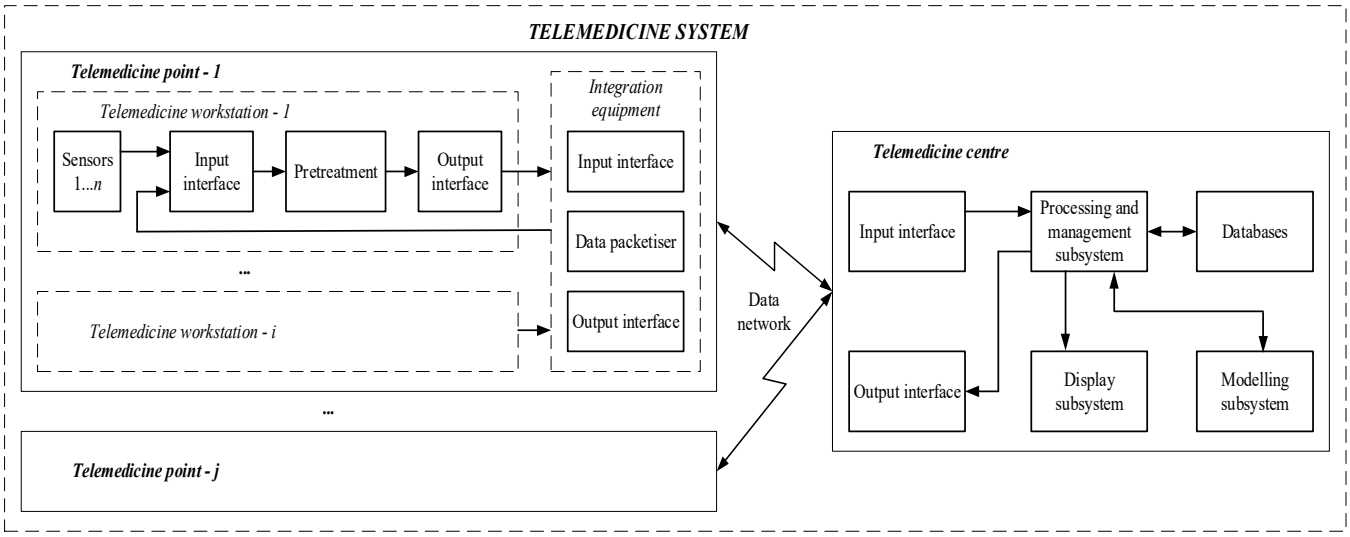

Fig. 1. Block scheme of the «Health» telemedicine system

These data are obtained when a patient is examined when they go to the doctor, undergo medical examinations or health check-ups and are used to assess their health status. On the basis of quantitative criteria in actual or conditional (point) units, the patient's condition is determined for each of the EHS and the overall assessment of the patient's health status, differentiating them into six health levels (the first is prohibitive, the second is minimal, the third is low, the fourth is average, the fifth is high, and the sixth is optimal). On the basis of the obtained assessment, it is possible to prognostically assess the dynamics of the health level in general and of each EHS separately ("positive" when establishing 5 and 6 health levels, "no change" when establishing 3 and 4 health levels, "negative" - when establishing 1 and 2 health levels), as well as to reasonably develop and propose TPM.

B. FIRST LAW OF FIC

In order to increase the accuracy of determining the level of health, it is necessary to take into account the mutual influence of EHS and the environmental situation in the area of residence. For this purpose, mathematical modelling is used.

At present differential equations, in particular, diffusion equations (Fick's first law), including nonlinear diffusion [4], Liouville equation [5], Fokker - Planck equation [5] are used in the models of analysing and forecasting the dynamics of human health level applied in practice.

When modelling the human state, diffusion processes take into account internal (mutual influence of systems and organs of the human organism) and external (state of the environment) processes and phenomena. The result of diffusion in this approach is a change in the level of health when the controlled parameter (CP) changes as a result of external or internal processes. If external forces act on the human organism or a gradient of any CP is maintained, then as a result of diffusion the gradients of all parameters of the human organism related to the CP are established.

The diffusion equation in the one-dimensional case $\rho = \rho(x)$ is Fick's first law:

$$\rho = -D\frac{d\rho}{dx} = -D\nabla\rho \qquad (1)$$

where ρ is the change of CP for time t in the direction x towards its decreasing value, $d\rho/dx = \nabla\rho$ - CP gradient, D - diffusion coefficient.

The diffusion coefficient acts as a coefficient of proportionality characterising the dynamism of change of CP and is determined empirically, as Fick's law also has an empirical character.

The physical meaning of the diffusion coefficient is that it is numerically equal to the change in the health level per unit time at a unit gradient of CP, i.e. the rate of change in the health level in certain conditions of human habitation [6].

C. AREA ZONING

To determine the diffusion coefficient D and the CP gradient ($\nabla\rho$), the method of territory zoning given in [7] is used (see Fig. 2). The CP gradient and diffusion coefficient obtained by this method are used in (1).

The method of zoning the territory according to the level of population health under the influence of risk factors (RF) developed by the authors is as follows.

A grid and control points for determining (measuring) CP values are drawn on the map of the analysed area. As such parameters can be chosen EHS, environmental quality parameters, technosphere objects.

Determination of the values of the selected CPs is carried out during examination of the patient when he/she goes to the doctor, during medical examinations or dispensary (for humans), during industrial-ecological control (for the environment and objects of the technosphere).

The values of the selected controls are plotted on the terrain map and the control values at the different control points are compared. After this analysis, control points with similar and/or identical CP values are combined into clusters on the map, clusters with identical CP values are connected by lines on the map, and the area is zoned according to the selected CP.

Fig. 2 shows an example of zoning of a human habitation zone by external CP (environmental) depending on the level of maximum permissible CP values set by regulatory documents.

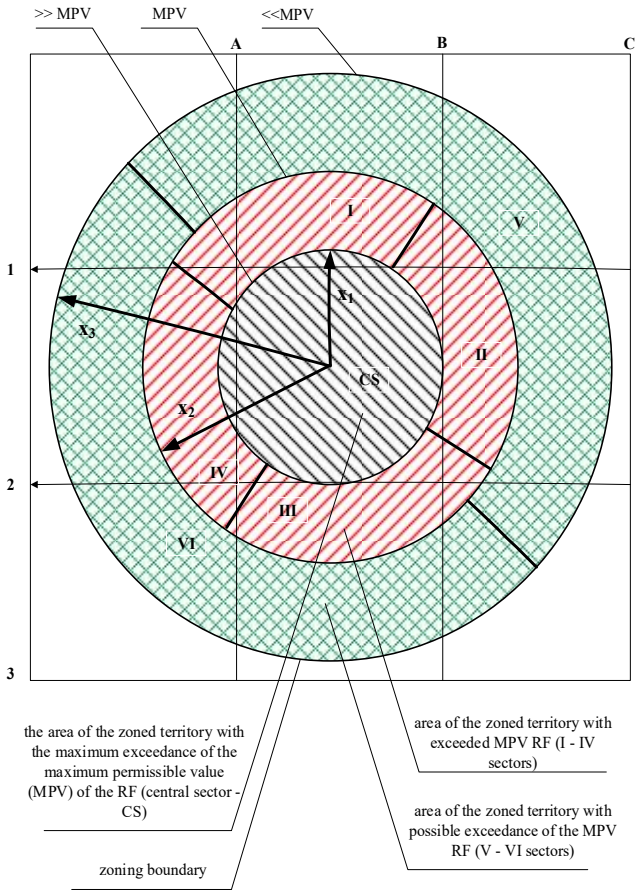

Fig. 2. Zoning of the territory according to the change in the gradient of the controlled parameter.

For each selected zone empirically set the value of diffusion coefficient, taking into account that

$$D = -\frac{\rho}{\nabla\rho}. \qquad (2)$$

The obtained results are plotted on the prepared map and then the CP gradient is determined and the zones with possible equal level of human health are formed on its basis.

D. PROCESS CONTROL

For people with the first and second levels of health and a negative prognosis of their change, as well as with the third and fourth levels of health and a prognosis with no change in them, it is necessary to develop a plan for conducting control studies to assess and improve the effectiveness of the implemented TPMs aimed at improving the dynamics and increasing the level of health.

To control the effectiveness of their implementation and prompt correction of deviations, the authors have developed a method of operational management of CP [8]. The scheme of the control algorithm in the "Health" system is shown in Fig. 3.

The proposed method makes it possible to control the values of EHS, as well as the effectiveness of TPM by: the values of CP, the time of implementation of measures, their number.

The purpose of operational control is to adjust the TPM implementation process in real time, if necessary, by managing the control during the event (see Fig. 4).

To effectively monitor and control CP in real time and adjust the progress of TPM, the authors propose to divide the normative flow time of the event, t_{norm}, into N time intervals using the formula:

$$N = \frac{t_{norm}}{t_{mon}}, \qquad (3)$$

where t_{norm} - normative flow time of the event, t_{mon} - time interval of the event monitoring. In this case, setting the time of modelling the change of CP during the event is carried out taking into account the condition $t_{mod} < t_{mon}$ cycle from 1 to N control in real time of the CP value of the event.

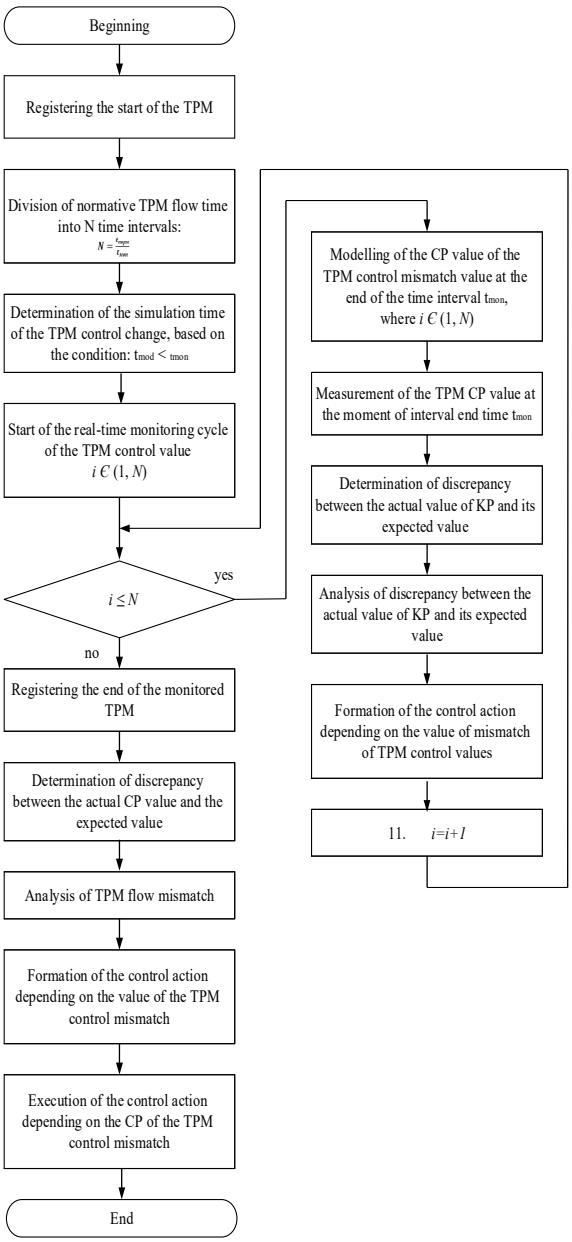

Fig. 3. Scheme of the control algorithm in the "Health" system.

In case the condition $i \leq N$ is fulfilled, the CP is modelled at the end of the current time interval t_{mon}^{i}.

Measurement of the CP value at the moment of the end of the interval t_{mon}^{i} will allow to determine the discrepancy between the actual CP value and its expected value. And also to correct the TPM stroke at each interval t_{mon}^{i+1}.

Analysis of the discrepancy between the actual value of CP and its expected value allows to form and implement a control

action depending on the value of the discrepancy between the actual value of CP and its expected value.

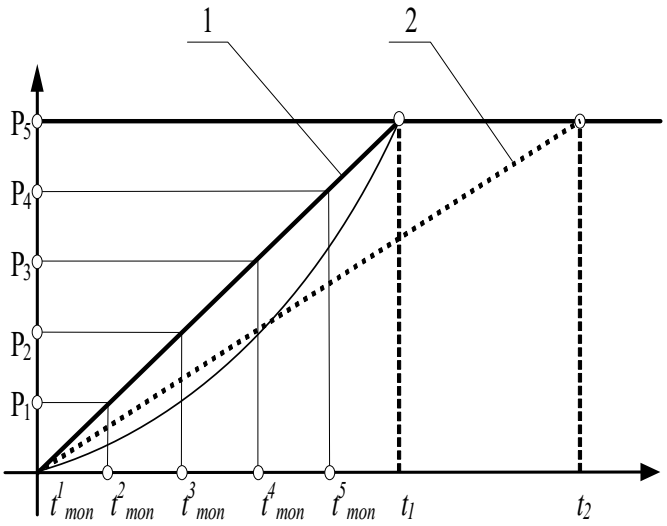

Fig. 4. Comparison diagram of therapeutic and preventive measures flow time with correction (1) and without correction (2) controlled parameters.

The developed method makes it possible to detect the mismatch of the actual CP value during the current TPM and to exert a control action before its end, at each of the intervals t_{mon}^{i}.

III. Results And Discussion

As part of the implementation of the proposed ways and means, the authors have developed an algorithm for assessing indicators in the "Health" system based on Fick's first law. The scheme of the algorithm is shown in Fig. 5.

A distinctive feature of the algorithm is the predictive evaluation of the dynamics of the human health level.

Indeed, the example of patient S., a 28-year-old man, showed the following. During examination and collection of EHS data it was revealed that he has poor heredity (no relatives have cases of surviving more than 60 years), low physical activity (less than 1 hour a day), diagnosis (type 1 diabetes mellitus, decompensated, ketoacidosis), disease history (3-4 years), living in an ecologically unfavourable area (maximum permissible concentration more than 100), low reserve capabilities of the organism (according to bicycle energetometry data, the volume of work performed was 1800 kgm/min, low level of non-specific resistance (blood content of immunoglobulin "j" was 910 mg/l and T liphocytes - 51%).

Translating this data into an aggregate EHS expressed in scores yields the results presented in Table 1 and Fig. 6.

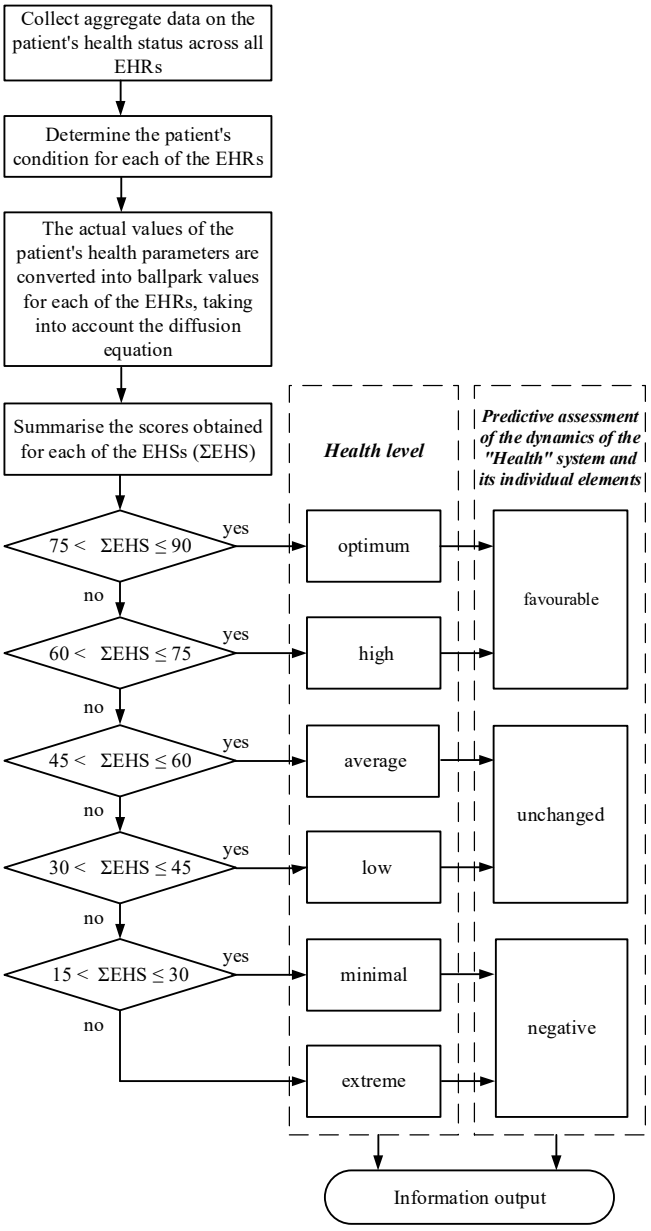

Fig. 5. Scheme of the algorithm for evaluation of indicators in the "Health" system based on Fick's first law.

TABLE I. VALUES OF THE ELEMENTS OF THE "HEALTH" SYSTEM FOR PATIENT WITH.

№	«Health» system element	
	Name	*Value, score*
1	Heredity	2
	Lifestyle:	
2	physical activity	1,40
3	intestinal function	0,60
4	sleep duration	1,40
5	duration of labour activity (daily)	1,40
6	presence of bad habits and occupational hazards	0,60
7	literacy and physical development	1
8	functional state of the body	2
9	level of non-specific resistance and immune defence	1
10	level of motivational health attitudes	1
11	disease or developmental defect	2
12	level of culture of social relations	3,4
13	external environment	8
14	level of accessible health care	4
Total points		29,8

The obtained result, in accordance with the algorithm shown in Figure 5, corresponds to the minimum level of

health, hence the prognostic assessment - negative dynamics of health development.

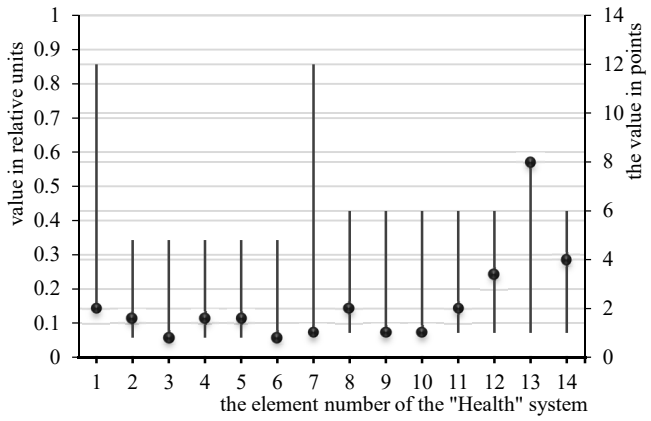

Fig. 6. Diagram of the elements of the "Health" system.

Obviously, it is necessary to conduct TPM in relation to patient S, the list and frequency of which is determined in accordance with the relevant standards and procedures of medical care, as well as clinical recommendations and control of TPM effectiveness according to formula (3).

IV. Conclusions

The proposed ways and means in the "Health" system provide real-time monitoring of a person's health status taking into account his/her zone of residence and thus justify the choice of TPM in case of necessity.

Funding: The work was supported by the grant of the Ministry of Science and Higher Education of the Russian Federation «Synthesis and research of promising nanomaterials, coatings and electronics devices» (№ 124041700069-0).

References

[1] Presidential Decree No. 254 of 6 June 2019 "On the Strategy for the Development of Healthcare in the Russian Federation for the period until 2025".

[2] Decree of the President of the Russian Federation from 07.05.2024 № 309 "On national development goals of the Russian Federation for the period up to 2030 and in the perspective up to 2036".

[3] Patent 2119768 Russian Federation, MPK A 61 B10/00. Method of integral estimation of human health / Shchetinin A.N. - No. 95115282/14 ; avt. 30.08.1995 ; published 10.10.1998.

[4] Fuentes M. (2018) Entropy, 20(9):649.

[5] Orlov Y. N., Fedorov S. L. (2016) Planka. TRUDY MFTI, 8(2):126–133. [Rus].

[6] Leushina, A.P. Molecular-kinetic properties of disperse systems. Sedimentation analysis: textbook / A.P. Leushina, D.N. Danilov. - Kirov: Izd-v VyatSU, 2008. - 54 c.

[7] Patent 2782525 Russian Federation, MPK G 16H 10/00. Method and system of territory zoning according to the level of risk for population health in conditions of exposure to chemically hazardous substances / Bezborodova O.E., Bodin O.N., Sherstnev V.V., Kholudeneva A.O., Martynov D.V. - No. 2021119277, avt. 17.08.2021; publ. 28.10.2022.

[8] Patent 2835476 Russian Federation, MPK G05B 15/02. Method of automated control of technological processes / Rudyuk M.Yu., Kholudeneva A.O., Bezborodova O.E., Bodin O.N., Sherstnev V.V., Martynov D.V. - No. 2024109646, filed. 10.04.2024; publ. 25.02.2025.

Contents

Preface 2

Section 1. Methods for Processing and Analyzing Biomedical Signals, Data and Images

Algorithm for Analyzing Digital Footprint of a Social Network User 4
Bodin Oleg N., Zhigachev Vasily M., Balaba Ulyana N., Golubkova Ilonna V.

Peculiarities of Evaluation of Indicators in the "Health" System Based on the Diffusion Equation 9
Bodin Oleg N., Bezborodova Oksana E., Zhigachev Vasily M., Mishina Kristina D., Martinov Dmitry V., Trofimov Aleksey A.

Digital Processing and Uncertainty Estimation of Electrocardiogram Signal Measurement in MATLAB 14
Khan Svetlana G., Zhussupbekov Sarsenbek S., Bayliev Yesen Zh.

A Comparative Study of Peritoneal Dialysis Effluent and Urine Chromatographic Fraction Composition with Optical Absorption and Fluorescence Spectroscopy 18
Ovsyannikov Nikolay, Mikhailis Milana, Krukov Andrey, Konoplev Georgii A., Stepanova Oksana V., Gerasimchuk Roman

Using ATP Bioluminescence and Fast Protein and Metabolites Liquid Chromatography for Determination of Free (Extracellular) Dietary Nucleotides in Ready-to-eat Fish and Meat Food as a Potential Factor Influencing Malignant Tumor Growth 22
Stepanova Oksana V., Kuznetsov Artur I., Lyalin Daniil, Lukyanov Maksim, Stepanova Oksana S., Konoplev Georgii A.

The Role of Neural Network in Classifying Electroencephalography 26
Asra H. AL-Dnenawe, Hayder J. Mohammed, Korovkin Nikolay V.

Algorithmic Methods for Realistic Synthetic Neuronal Dendrite Surface Generation 31
Krylova Ekaterina O., Smirnova Daria S., Chukanov Vyacheslav S., Pchitskaya Ekaterina I.

Identification of the Morphology of the High-Frequency Part of Ultra-High Resolution Electrocardiosignals 35
Afanasenko Arseniy, Shevyakov Daniil

Application of an Algorithm Based on Transformer Neural Network for Classification of Ultra-high Resolution Electrocardiosignals 39
Denisova Elena A., Kordyukova Anna A., Mirametov Ali

Structural Analysis of Spatial Dendritic Spines Distribution Patterns in Norm and Alzheimer's Disease Pathology 42
Lips Ekaterina K., Smirnova Daria S., Chukanov Vyacheslav S., Pchitskaya Ekaterina I.

Method for Real Time and Continuous Assessment of Arterial Stiffness 47
Yangirov Marat A., Al-harosh Mugeb. Ryzhkov Valeriy, Ionova Aleksandra, Shchukin Sergey I.

Development of Electrical Impedance Caliperometry Methods for Assessing Skin-Fat Layer Properties 51
Briko Andrey N., Smirnova Tatyana, Chibizov Pavel, Kapravchuk Vladislava, Kobelev Alexander V., Shchukin Sergey I.

Mathematical Models of Forearm Tissues in Bioimpedance Measurements 56
Kobelev Alexander V., Briko Andrey N., Shchukin Sergey I.

Development of a Software Algorithm for Processing and Analysis of Video Photoplethysmogram Signals 60
Derevesnikova Darya, Ziganurova Diana, Luzhnov Petr, Guryleva Anastasia, Machikhin Alexandr

Assessing the Impact of Auditory Stimulus Parameter on Cognitive Evoked Related Potential 64
Filimonova Anna V., Dmitriev Alexander N.

Algorithms for Automatic Detection of Sporadic Epileptiform Discharges in the Diagnosis of Delayed Cerebral Ischemia after Subarachnoid Hemorrhage 70
Obukhov Yury, Kershner Ivan, Okuneva Irina, Sinkin Mikhail

Machine Learning-Based Detection of Pain from EEG Signals 74
Ryabkin Dmitriy I., Pustovit Georgiy, Gerasimenko Alexander

Noise Suppression in Biomedical Signals Based on Modified Empirical Mode Decomposition 78
Krivonogov Leonid Yu., Gerashchenko Sergey I., Papshev Dmitry V., Kryanina Polina D., Khalyapina Evgenia S.

Analysis of Acoustic Characteristics of Speech for Assessing Emotional Stress: Methods and Experimental Studies 84
Melnik Olga V., Babaev Sergey I., Saraev Mikhail N.

Processing of Images of Radiocontrast Coronary Angiography Using the Dual Spectral Scanning Method 90
Kuzmin Alexander, Filist Sergey, Sukhomlinov Artem, Halin Igor, Korobkov Sergey, Fatnev Dmitry

Comparative Analysis of Approaches to Segmentation of Medical Images Based on CT of Human Internal Organs 96
Rudenko Marina, Rudenko Andrei

Investigation of the Asymmetry of the Mu Rhythm on the EEG During the Activation of the Mirror Neuron System in Individuals after Stroke 101
Chernyshov Denis S., Alimuradov Alan K., Allanova Julia V., Tychkov Alexander Yu., Churakov Petr P., Chernyshova Yana A.

Computer Aided Spine Analysis Using Deep Learning for Vertebral Detection, Segmentation and 3D Reconstruction from X-Ray Images 105
Ugolnikova Ekaterina A.

An Algorithm for Predicting Sudden Cardiac Death Using Heart Rate Variability Parameters 109
Manilo Lyudmila, Menshikova Vasilisa, Nemirko Anatoly, Yuldashev Zafar, Tatarinova Anna, Stepanov Danila

Study of Parameters of Chaotic Heart Rhythm in Patients with Pulmonary Pathologies 114
Antipov Nikita O., Kalinichenko Alexander N.

Approaches for Determining Boundary Values of Parameters in the Feature Space of Blood Pressure and Stroke Volume 117
Sergeev Timofey V., Anisimov Aleksei A., Sokolova Evgenia A., Ryzhov Mikhail V.

Sampling Representation of CT Images by the Receptive Field Occupation Number Model 121
Antsiperov Viacheslav, Kershner Vladislav, Mansurov Gennady

Application of Neural Networks for Differential Diagnosis of Inflammatory Bowel Diseases by Analyzing Endoscopic and Histological Images 126
Mashevskiy Gleb A., Rasmagina Irina A., Shelyakina Natalia M., Bakulin Igor G.

Section 2 - Medical Devices, Systems and Complexes for Diagnostics, Monitoring, Treatment and Rehabilitation

Improvement of Non-Invasive Electrocardiodiagnostics Screening System Based on Modern Information Technologies .. 132
Bodin Andrey Yu., Bodin Oleg N., Kramm Mikhail N., Rakhmatullov Ruslan K., Rakhmatullov Fagim K., Serzhantova Natalia A.

Automated System for Remote Monitoring of Epileptic Seizures 137
Titova Ilona I., Bratchenko Lev S., Kasyanova Yana S.

Influence of Low-Intense Microwave Radiation on the Academic Stress of Students 141
Konev Alexander, Petrenko Anna, Kublanov Vladimir S.

Hardware-Software System for Remote Monitoring of the Respiratory System 146
Kublanov Vladimir S., Dyachenko Alexander I., Nevstruev Dmitry S., Vylegzhanin Gregory S., Khanin Evgeny V., Nasyrov Roman A.

Personalised SMART Monitoring of Critical Cardiac Muscule Functioning Conditions Based on a Smartphone 153
Artemenko Michail V., Shutkin Alexander N., Kvashnina Galina A., Fedyanin Vitaly I.

Study of Optical System Elements' Characteristics for Non-Invasive Glucose Measurement in Biological Medium 160
Mikhailov Mikhail O., Pozhar Kirill V., Litinskaia Evgeniia L.

Technology of Thin-Film Neuroimplant for Biosensorics and Neuromodulation 164
Isaev Nikita, Iusupovskaia Elena, Markov Alexander, Telyshev Dmitry

Design and Implementation of a Mobile Hardware System for Real-Time Analysis of Human Posture in the Frontal Plane During Walking 167
Ibrahim Anagheem

Development of Human Body Impedance Active Resistance Meter 171
Aleksanyan Grayr K., Konko Maria A., Gorbatenko Nikolay I., Narakidze Nuri D.

Thermophysical Prediction Model of Local Cryotherapy 176
Saakyan Natalia, Pushkarev Aleksandr, Chekmenyov Vladimir, Makhmutova Yulia

Accounting for Changing That the Measuring Sensor Makes into the Frequency Characteristics of Brain Tissue Impedance 180
Epanchinov Dmitry A., Gerasimenko Alexandra E., Yashkardin Rostislav V.

Numerical Simulation of High-frequency Current Flow Processes in Dental Tissues Affected by Caries 184
Ermolaev Nickolaj A., Gorelikova Maria A.

Investigation of the Chest Model for the Problem of Choosing the Size of Electrode Monitoring Systems for the Regional Ventilation-Perfusion Ratio 188
Gorin Nikita A., Plytkivich Georgii Ye., Shchukin Sergey I.

Mathematical Modeling and Comparative Control of Direct-Drive Lens System Based on LQR and Neural Network Approach for Pupil Tracking in Teleophthalmology Tasks 192
Mayya Ali Sultan, Moussa Zein Mohammad

A Physical Phantom of a Premature Baby for Simulation Studies of Thermophysical Processes in Neonatal Incubators 197
Frolov Sergey V., Korobov Artem A., Savinova Kristina S., Potlov Anton Yu., Frolova Tatyana A.

3D Personalised Modeling of an Aortic Valve 202
Alekseev Denis, Gaisin Shamil, Nazaryan Aikush, Gumerov Ruslan, Afanasyev Ilya, Avsievich Alexandr, Ivaschenko Anton, Kuzmin Andrey

Development of Device for Objective Monitoring of Valsalva Maneuver 205
Anisimov Aleksei A., Seleznev Dmitry A., Skorobogatova Alena I., Larina Marina A.

A Hardware and Software Complex for Automated Analysis of the Functional State of Feet Based on Computer Plantograms 209
Mikhailishin Viktor V., Smirnova Ludmila M., Khazov Valentin A.

A Comparative Evaluation of Spatial Frequency Domain Imaging and Diffuse Reflectance Spectroscopy in Measuring Tissue-Mimicking Phantom Optical Properties 213
Kolpakov Alexander V., Sokolova Diana Yu., Semenova Anastasia S.

Electrical Impedance Mapping Method of Back Muscles in the Area of Damaged Intervertebral Discs 218
Blinov Andrei A.

Towards a Digital Platform for Tailoring Freeze-Thaw Protocols for Tissue Decellularization 222
Ivannikova Valeria, Pushkarev Aleksandr, Tsiganov Dmitry

Section 3. Medical Decision Support Systems. Intelligent Systems in Healthcare

Fuzzy Models for Assessing the Protective Functions of the Body Based on Its Antioxidant Status for Medical Expert Systems 228
Korenevsky Nikolay A., Rodionova Sofya N., Seregin Stanislav P., Kholimenko Ivan M., Tsukanova Margarita N.

Growth Prediction of Primary Extra-Axial Brain Tumors of Magnetic Resonance Images Based on Deep Learning 234
Selezneva Alisa A., Ilyasova Natalya Yu., Demin Nikita S., Surovcev Evgeniy N., Kapishnikov Aleksandr V.

Accuracy and Efficiency of Neural Network Models in the Diagnosis of Obstructive Micturition 238
Panferov Alexandr S., Gadzhiev Nariman K., Yastrebov Vitaly S., Filist Sergey A., Puchenkov Kirill I., Zhilin Ilya A.

Development of a Clinical Decision Support System on Selection of Laser Radiation Characteristics and Component Composition of Laser Solder for Laser Reconstruction of Biological Tissue Integrity 243
Suchkova Victoria V., Ryabkin Dmitry I., Selishchev Sergey V., Gerasimenko Alexander Yu.

Extraction of Informative Features for Optical Biopsy Data Analysis 246
Matveeva Irina

Comparison of Neural Network and Hybrid Approaches in Analyzing Spine Radiographs of Osteoporosis Diagnosis 250
Nekrasova D.V., Ilyasova Natalya Yu., Zarov Evgeniy V., Demin Nikita S., Pervushkin Sergey S.

A Novel Deep Learning Prototype for Alzheimer's Disease Detection 254
Karim Sabry Ramadan Attia, Housam Hasan Bou Issa, Alrawi Adnan

Module for Automated Assessment of Visual Function Safety in the Diagnosis of Multiple Sclerosis 257
Bolsunov Konstantin N., Gapanenok Alexandra E.

Technology of Localization Pathological Accumulation Foci of Radiopharmaceutical Based on Deep Learning Methods 261
Ilyasova Natalya Yu., Gulinskaya Irina I., Demin Nikita S., Delov Konstantin E., Alekhin Eduard N.

Algorithm for Automatic Determination of Indications for 2RT-Laser Treatment Based on Optical Coherence Tomography Images 265
Ionov Artem Yu., Ilyasova Natalya Yu., Demin Nikita S., Dotsenko Kamila R., Zolotarev Andrey V.

Modeling of Patient's Informative Parameters for Neural Network Support of Medical Decision 269
Kostenkova Mariya Yu., Gerashchenko Mikhail S., Gerashchenko Sergey I.

Prototypical Networks for Neurovascular Inclusions Identification by Frequency Domain Near Infrared Spectroscopy in Neurosurgery 273
Belsheva Mariia N., Safonova Larisa P., Shkarubo Alexey N., Chernov Ilya V.

Real-Time Object Avoidance Algorithm Using Computer Vision for the Visually Impaired Through Audio Feedback 278
Palogiannidis Dimitrios

Development of a Method for Face Asymmetry Estimation in Neuroscience Tasks Based on Facial Landmarks Coordinates 283
Boyko Andrey A., Rimkevichus Anastasia A., Kirichenko Olga A., Samorodov Andrey V., Suponeva Natalia A.

Neural Network Models for Diagnosing Lung Diseases 287
Magrupov Talat, Akhmedzhanov Ravshanjon, Magrupova Maloxat, Radjabov Akhmedkhan, Abdihalikov Seit, Gaibnazarov Sardorkhon

Binary Classifier for Detecting Gas Exchange Shifts During Full Yoga Breathing Using Blood Microcirculation Data 291
Ermolaeva Sargylana A., Frolov Artem V., Dunaev Andrey V.

Formation of a Complex of Diagnostically Significant Indicators for Predicting the Outcomes of Assisted Reproductive Technologies and Pregnancy Pathologies 294
Semenova Evgeniia A., Ripka Darina S.

Section 4. Digital Health Technologies

Modeling Human Breathing Patterns Using Electrical Impedance Tomography 298
Aleksanyan Grayr K., Konko Maria A., Temnyakov Nikolay S., Gorbatenko Nikolay I.

Design of Brain Vessel Phantom Model with Aneurysm for Bench Tests Using Optical Flow Visualization Methods 302
Gorina Anastasia V., Galiastov Andrei A., Stavtsev Dmitry D., Konovalov Anton N., Grebenev Fyodor V., Telyshev Dmitry V.

Analysis of HRV Parameters Calculation at Different Sampling Rates of the ECG Signal 305
Adamova Alice, Kuzmin Andrey

Technology of Speech Signal Representation Based on Empirical Mode Decomposition 310
Alimuradov Alan K., Tychkov Alexander Yu., Churakov Pyotr P., Mamonova Anna A., Chernyshov Denis S., Temirova Jamilya A.

Noninvasive Assessment of Fractionl Blood Flow Reserve in Coronary Artery 315
Akhmetgalieva Elvira R., Sharafeev Aydar Z., Musin Ildar N., Tazyukov Faruk Kh., Lisanevich Mariia S., Kislukhin Temur V.

Comprehensive Assessment of the Current Health State of the Pregnant Woman Outside the Clinic 319
Korneeva Inna P., Shalobyta Helen N., Gushin Valery M.

The Method and Telemedicine System for the Dynamic Correction of the Stereotype of the Interaction of the Feet with the Support 323
Daminova Emiliia A.

A Model for Dermatoscopic Image Recognition Combining Classical and Neural Network AI Techniques 328
Nikitayev Valentin G., Sergeev Vasily Y., Kozlov Vladimir S.

Section 5. Innovation Management and Quality Assurance in Healthcare

Electrochemical Method of Dialysate Regeneration for Wearable Artificial Kidney Devices 333
Putrya Boris

Organic Semiconductor-Based Stimulation Device for Peripheral Nerve Regeneration 338
Iusupovskaia Elena, Markov Alexander, Grechina Anastasiia, Umryukhin Alexey, Telyshev Dmitry

Possibilities of Recording Peripheral Blood Flow and Oxidative Metabolism of Biological Tissues under the Orthostatic Effects during Cosmonaut Training 341
Loktionova Yulia I., Kireev Kirill S., Zharkikh Elena V., Lutsevich Dmitry, Yanusnin Vyacheslav S., Sidorov Victor V., Dunaev Andrey V.

Ultrasound Interaction with Cortical Bone: a Fully Theoretical Framework 345
Jamal Al-Nabulsi, Housam Hasan Bou Issa, Haitao Mei

Section 6. Educational technologies in biomedical engineering

Docking and Molecular Dynamics Study of Silk Fibroin Interactions with Carbon Nanotube 350
Huy Le Nhat, Hanh Thi-Thu Tran, Khizbullin Robert N., Khizbullin Radik N.

Non-Contact Respiratory Movement Recording in the Bed Rest and Short Arm Human Centrifuge Experiment 355
Dyachenko Alexander I., Kublanov Vladimir S., Ermolaev Eugene S., Demin Artem V., Shulagin Yury A., Nevstruev Dmitry S., Vylegzhanin Gregory S., Shpakov Alexey V., Khanin Evgeny V., Kovrov Gennady V., Nasyrov Roman A.

Modeling the Process of Transferring Hydrocuff Pressure from the Forearm Surface to the Artery 361
Gerashchenko Mikhail S., Tynda Aleksandr N., Gerashchenko Sergey I.

Pulse Waves Numerical Modeling in the Problem of Blood Pressure Measurement Accuracy Increasing in Hydrocuff Tonometers 365
Tynda Aleksandr N., Gerashchenko Mikhail S., Gerashchenko Sergey I.

Educational Technology Based on a Problem-Oriented VR Environment 368
Zolotarev Ruslan, Pisarev Maxim

Effect of Saline Solution (0.9% NaCl) on Brain Tumor Impedance Measurements Results in Vitro 373
Gerasimenko Alexandra E., Epanchinov Dmitry A.

Stabilometric Studies of Patients after Total Knee Arthroplasty Using Mechanical and Kinematic Alignment 377
Kolesnikov Daniil A., Bilal Sulaiman, Boyko Andrey A., Kuzin Victor V., Samorodov Andrey V., Kuzin Anton V., Germanov Aleksei V.

Database Structure for Studying Foci of Contamination by Protective Devices 381
Beltyukov Michael V.

Author Index 390