Materials of the Conferences

MODELLING AND ALGORITMIZATION OF MANAGEMENT IN BIOTECHNICAL SYSTEM OF THE GAME AUTOMOBILE TRANING

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The urgency of research. The computer game biocontrol is a new rapidly developing treatment-and-improving technology at the turn of medicine, physiology, physiotherapy, electronics and programming. The basis of the biocontrol is a universal principle of the biological feedback: registered physiological parameter, the subject for correction is presented on the screen with interface, and a patient, observing his physiological function dynamically and using the skills of self-regulation, learns how to change it in a necessary for treatment direction. [M.B. Shtark, 2004].

The principle of the biological feedback gives an opportunity to the patient to become an active subject of the curing process instead of being passive object of the medical manipulations.

The urgency of the game biocontrol varients is guaranteed by the constant grows of stress, leading to numerous physiological and psychological deseases.

The computer game training apparatus contains several game plots which have an obvious or a concealed competitive character. The course of competition is regulated with dynamics of a registered physiological parameter: it may be a pulse rate, a cuteneous temperature, a galvanic skin reflex, CO_2 concentration in an exhalant air. The patient can win the competition in case if he learns how to control his physiological function in a situation of a virtual competitive stress. Colorful game plots, created with the use of the modern multimedia technologies, raise the motivation of a trained patient, contribute to more effective fixation of the autoregulation skills. [O.A. Jafarova, M.B. Sthark, 2003]. In the course of the game training a man gets an invaluable ability to resist stress and different deseases, to learn how to react on conflict situations in a new way, to reduce an excessive inner tension in that case when he needs an additional capacity for work, conation and mobilization of attention.

There are some known biocontrol games, developed in Scientific Research Institute (SRI) of molecular biology and biophysics of Russian Academy of Medical Sciences in Novosibirsk. Game hardware-software complex “Bos-Pulse” was permitted by Ministry of Health of Russian Federation for release and treatment –and – reabilitation technology of computer game biocontrol is recommended by the Academic Counsil of the Russian Ministry of Health.

It should be mentioned about the disadvantages of these games. First of all, the technical realization of the examined games is carried out in the near actual time that is connected with a sensor construction and multitask Windows environment.

Secondly, all these games are based on the control of a certain parameter, a pulse rate (magic cubes, car race, row channel skin divers), or an amplitude of B-rhythm of Electroencephalogram (planting of flowers), or CO_2 concentration in an expiration air (Martian wars). By the way, it is well-known, that the reaction of a separate organism functional system on the environmental changes always “is an integration of a large quantity of factors, none of which can be changed separately in such way to become quite efficient” [Barkroft, 1937]. It is connected with the multifrequent codes’ structure of physiological process biocontrol.

Experimental research, conducted at cell, tissues, organs level, showed that biological codes are multifrequent and their efficiency depends on a certain proportion in a complicatively modulated total signal. Also it was identified that a single wave-length action is dumped actively by an organism at the addressed level due to over – and underlying levels of homeostatic regulation. (S.L. Zaguskin, 1986).

That’s why using for biocontrol of one, even a very important parameter instead of a

multifrequent code may not be only effective, but also harmful.

Therefore, the development of biocontrol game technologies, based on the use of multifrequent codes, refers to the urgent problems of research.

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The aim of the research: to increase management efficiency in a functional condition of a man in a situation of a virtual competitive stress due to the usage of the multiparametrial management sygnal in the form of a pulse rate, respiration rate and their correlation.

The problems of research:

To develop the algorithms of the electrophysiological data input, allowing to register, to process and to analyze mathematically the physiological signal on the line.

To formulate the models of a game plot, managed by the physiological parameters of a pulse, respiration, and their correlation.

To develop the game environment models.

To conduct the parameterization of a management model of the human physiological functions including a pulse rate dynamics, a respiration rate dynamics and their correlations.

To develop and carry out a program device of a biomanagement technology in a virtual game environment.

The methods of research: in the research will be used the methods of systematic analysis, modeling, mathematic statistics, the methods of registration and analysis of electrophysiological data in the form of a pulse and respiration sensor and an examination of rhythm.

The description of a system based on the biological feedback.

The projected system contains: a device of a pulse and respiration sensors conjunction with a personal computer and program package, providing a biomanagement technology in a virtual game environment.

Scheme (block 1) on the microcontroller plays the digitization function of analog signals (electropfysiological data input on line) from the sensors of a pulse and respiration (block 2 and block 3) with the following transmission of the digital significance on protocol RS-232.

The program part of a system is based on a automobile emulator, in which an object of control is an automobile, run with the physiological data sensors' signals according to the developed algorithm.

The structural scheme of hardware is conducted in a module execution.

The main managing element of a system is a 8 bit microcontroller PIC16F870 of Microchip, working at a frequency 20 MHz and containing 2 kb of a program memory, 128 bytes of RAM and 64 bytes of interior EEPROM memory. To organize the connection with external devices, there is a module of a universal synchronous-asynchronous transceiver USART. To receive and process the analog data in chip there is a 5-chanel ADC. The pulse sensor data (channel 1) (blocks 1,2,3), the respiration sensor data (channel 2) (block 3), and also a supply voltage data of block 10, which is done as making up of 4 accumulators VARTA (4x1,2V), comes to the analog input of a controller.

In the pulse sensor the signal is taken of a photocoupler (2), intensified in an operational amplifier (1), in which also in-phase components (disturbance) are suppressed., then the signal is gated through the filter of low frequency (4), scaled (the amplitude of a signal is brought to 5 Volts) in block 5 and is given to the analog input ADC1 of a microcontroller 6.

In the respiration sensor the signal is taken of photocoupler 3 (it consists of a light diode and photodiode, located in front of each other) and given to the analog input ADC2 of a microcontroller 6. The data of a supply voltage comes to the analog input ADC3 of a microcontroller 6.

Module 7 serves to indicate the battery's discharge and presence of a pulse sensor signal. The device is connected to the computer via port RS-232C. Microcontroller 6 exchanges data with the help of signal lines (input – RX

and output - TX) of a transceiver USART using a driver RS232C with PC9.

The device works under the guidance of program modules, a part of which is stored in the internal nonvolatile FLASH program memory of a microcontroller 6.

The structural schema of a control algorithm is shown on picture 3. In program module 2 the initialization of the main registers of the microcontroller takes place. This program part is responsible for a setup of microcontroller's hardware-software resources. Futher, according to the program the central processing device of control codes and their transmitting (codes of frequency of digitalization and activation of device) (program modules 3, 4, 5). In PM 6 the analog signals of inputs ADC 1,2,3 are transformed in to a digital form, in blocks 7,8 there is a check out on battaries's discharge (in case, if the condition is fulfilled, the discharge indicator is on and the program does in cycles.) If the condition of discharge is not fulfilled, then consistency in modules 11,12,13 a data package, consisting of a single synchrobyte, 2 bytes of digital data representation of respiration analog, and 1 byte of a control sum is transmitted on protocol RS232C to the computer.

Game environment consists of traffic lines which go through the cross-country.

Two automobiles take part in the game. The first one is run with rates corresponding to the physiological parameters of a pulse, a respiration, and their correlations. The second one is a program in accordance with given tasks.

The game begins with a joint start of two automobiles in a virtual city. Every circle passed by cars is subdivided into three parts: a virtual city, a forest and cross-country.

The city is presented with a residential area, streets, different types of houses, pavements, street lamps, trees, viaducts, fountains, side streets. The forest is represented with green plantations.

The ups and downs of a road are located in a cross-country among the hilly fields. The game is constructed in such a way, that every new circle automobiles move on a rout, quit different from the previous one. It has been done purposely to prevent the feeling of boredom and routine of a common plot with a patient.

Driving, that is changing the position of a car toward a rival car, is conducted according to a specially developed algorithm.

The control correlation is a pulse and respiration frequency.

A patient's automobile takes the leading position in a satisfying correlation of a pulse and respiration. In the opposite case the situation changes on the contrary.

To preserve a game stress situation both automobiles are well-seen to the patient, in case he becomes a loser, his rival's car is well seen and vice versa.

Different types of operators activity, which require the usage of physiological resources of activation or relaxation, have been used in the research. It depends on the usage of different strategies: directed to the success or the escape of the failure.

In the first case the player should increase heartbeat rate and the amplitude of β-rhythm of EEG. It makes the aim of increasing the speed of a playing object achievable.

The second strategy is connected with minimization of expenses, preserving the energetic resources and it is conducted with reducing of a pulse rate and increasing of an amplitude of α-rhythm.

If the player is active, his pulse grows is positive and the moving speed of the playing object is the smallest, achieving the aim becomes rather difficult.

All medical algorithms of two studied game strategies are developed by professor F.A. Pyatakovich and Assistant – professor K.F. Mackonen.

Table 2 – The algorithm of program for microcontroller

№			
1	Access point		
2	The initialization of microcontroller's registers (PIC16F870)		
3	A routine for waiting for reception of control codes		
4	Is the code has been received?	Negative	Back to routine (2-3)
		Positive	Go to routine(5)
5	Translation and execution of control codes		
6	The analog to digital conversation of signals from all analog channels		
7	K(ADC)>Klim?	Negative	Back to routine (8)
		Positive	Go to routine (9)
8	Turn on the indicator of battery discharging		Back to routine (5-6)
9	Turn off the indicator of battery discharging		
10	CRC calculation		
11	A routine for synchro-byte of frame beginning uploading to USART		
12	A routine for uploading of counts (channels 1 and 2 of ADC) to USART		
13	A routine for CRC uploading		Back to (5-6)

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MECHANISMS OF HISTOGENESIS AND CYTOMORPHOGENESIS OF EPITHELIOID CELLS IN CHRONIC GRANULOMATOUS PROCESSES. THE FACTS AND HYPOTHESES

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It is known that during an embryogenesis the number of cell-like types will be derivated strictly particular for each species of organism, each of which has only to it intrinsic morphophysiological characteristic. One cells function only at particular stages embryonal development and then fade in outcome apoptotic death, others, on the contrary, are characteristic only for an adult organism. However, in researching granulomas forming at some granulomatousis diseases, already for a long time the cells were circumscribed which are not occur in a healthy organism. To number of such cells referred «basophilic hystiocytes» in rheumatic disease, Mikulich cells in scleroma, epithelioid cells (EC), formating epithelioid cell granulomas in a number of infectious, allergic and autoimmune diseases, and also other forms of atypical cells.

It was shown that EC forming in the nidus of the inflammation in granulomatousis diseases of different etiology. Suppose that EC do not enter number of differentiated cell-like types neither embryonic not adult organism; they occur only at particular pathological statuses and forming EC-granulomas. This granulomas determine clinicomorphologic essence of many granulomatousis diseases in man. Moreover, the EC-granulomas form in different groups animals relating to different branches of "phylogenetic tree". Thus, epithelioid cell formation in the nidus of inflammation can be related to one of most ancient mechanisms of cell-like response on imbalance of the «antigenic-structural" homeostasis in organism.

The concept of EC origin from cells of macrophage family till now is considered conventional, which some theoretical fundamentals were hypotheca in workers of Ashoff L. (1924) and Maksimov A.A. (1926). Affirms that EC transform from macrophages (Mph) located in the nidus where the pathological process flows past and under some conditions - directly from monocytes of a blood. This concept undations on a hypothesis that in a basis of the differentiation resulting in to derivation EC from Mph in reply to particular