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MICROSYSTEM FOR OBSERVATION AND COMPLEX PROBING OF A CONDITION CARDIOVASCULAR SYSTEMS

This the article represents your attention the concept development of gears for the complex analysis of a condition intimately - vascular system. In ours time there is a set of similar gears however in realization of the majority of them there is a comprehensive approach. In this to the article the frame development of a gear realization on a modular approach is presented. In frame the separation of the analysis on three levels is exhibited: a level of the patient, expert and consultation. The signals on which conduct the analysis of a condition intimately - vascular system are presented. The synthesis and account of performances in a packet application programs "Math Cad" is conducted. This the article will be interesting to the students of technical specialties, and also all experts on development medical apparatus.

INTRODUCTION

One of actual problems of a modern medical electronics engineering is the development of electronic devices, complexes and systems for observation behind a condition of a human organism with the purpose of monitoring and analysis of the basic vital functional parameters and warning of origin of critical conditions. The special attention is given to the equipment for probing and analysis of a cardiovascular system of the person. (CVS)

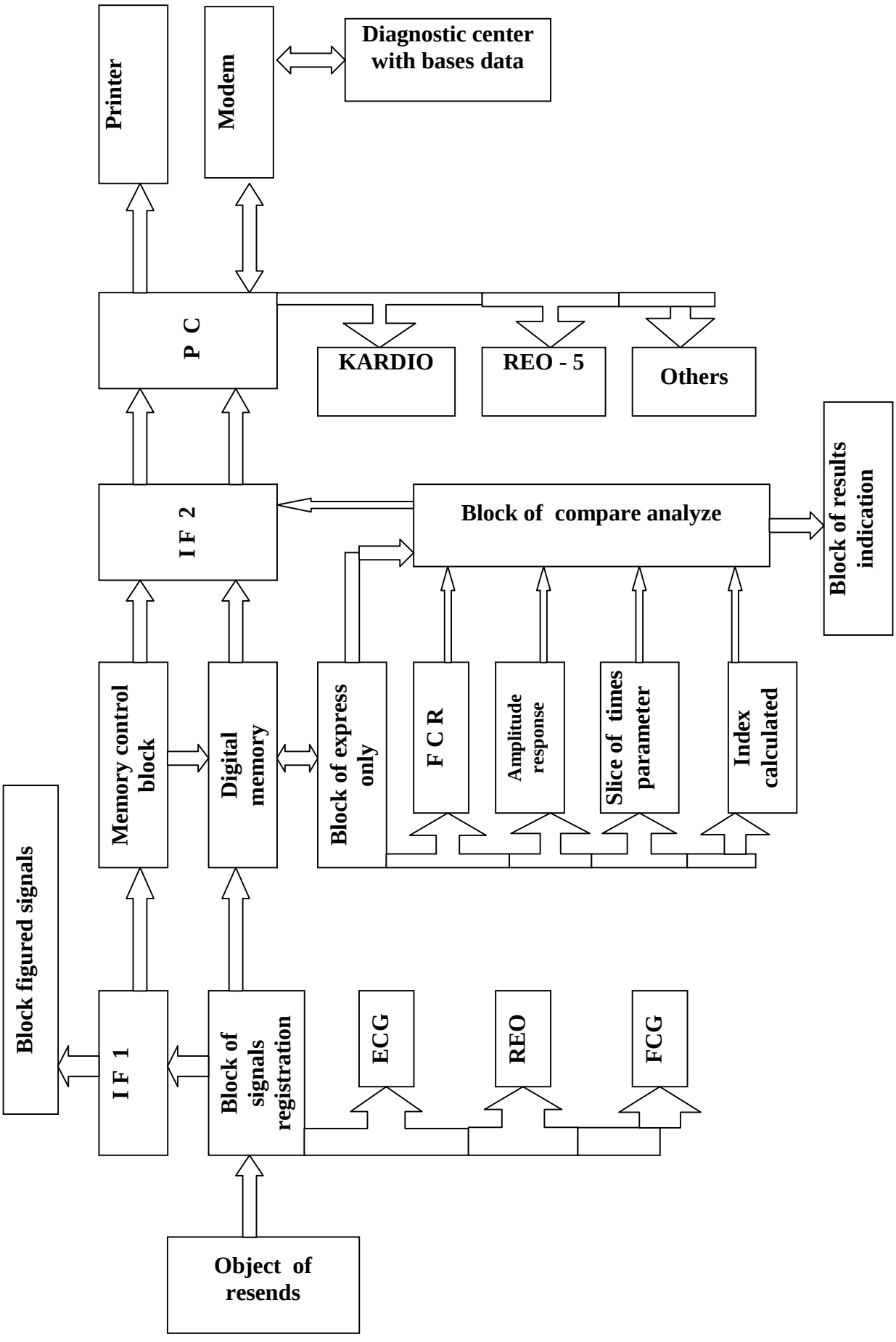
STRUCTURE DEVICE

Among them it is possible to select:

– Stationary complexes with computer processing of outcomes (« Ritmonom », DX-Systems), which allow to conduct round-the-clock monitoring of electrocardiograms (ECG) of the several patients, to make arrhythmia analyses and to change a cardiac rhythm and to meter parameters ECG [1];

– Group of the portable electronic equipment for the express train - analysis of a condition CVS with microprocessor management on the basis PC (Notebook). Such systems(devices) allow to conduct simultaneous registration EKG in several (1-12) abductions, automatically to store the PC up to 40 cardiograms, to define some fundamental parameters ECG - of signals (TCARD, Page Writer 300pi, Fukuda M-E Cardisuny Alpha 5000 AX) [2];

– Systems (device) of medical telemeter (ECG BRK, Fukuda M-E Cardisuny Alpha 2000 AX, MAC500), which grant a possibility of registration ECG of a signal with the further transfer through the modem - telephone network in computer diagnostic centers.



It is possible to mark major heterogeneity single-minded systems(devices) and absence of the comprehensive approach at development of the equipment, that does not allow to conduct probing CVS at different levels: from simple observation and monitoring of parameters for a long time through microelectronic gears of individual use with digital memory to the complex analysis at computer diagnostic center.

In a general view the frame of an overall system for long-lived observation and probing of a condition of a cardiovascular system is presented in a fig. 1. Such system is constructed on a modular approach and provides a possibility of organization of operation at three levels:

1. Floor (user - patient);
2. Average level (expert);
3. Highest level (consultation).

The circuitry realization of such frame at the first level can be executed on the basis microsystems of a minimal configuration, into which enter the microprocessor, operative (Dynamic memory – D. M.) and constant (State memory – S. M.) of tape recorders (digital memory with control diagrams), interface circuits(schemes) for maintenance of the agreed operation of all system components.

Readout biomedical (BMS) of signals (ECG, REO, FCG, PCG) through the block of registration of signals note in digital memory of a gear. The microprocessor box ensures realization of an express train - data analysis, according to the given program of probing. Depending on a type of a signal and algorithm of probing it is possible by a program way to define frequency of cardio reductions (FCR), peak, hour, interval parameters of biosignals of heart and vessels in one or several abductions; to expect control parameters and indexes, to conduct the comparative analysis with standard significance's BMS, (which previously can be noted in S.M.), to reveal possible(probable) deviations(rejections) of parameters from norm and to shape the recommendations for the further analysis. For submission of outcomes the block of map of signals and block of display of outcomes of the analysis is stipulated.

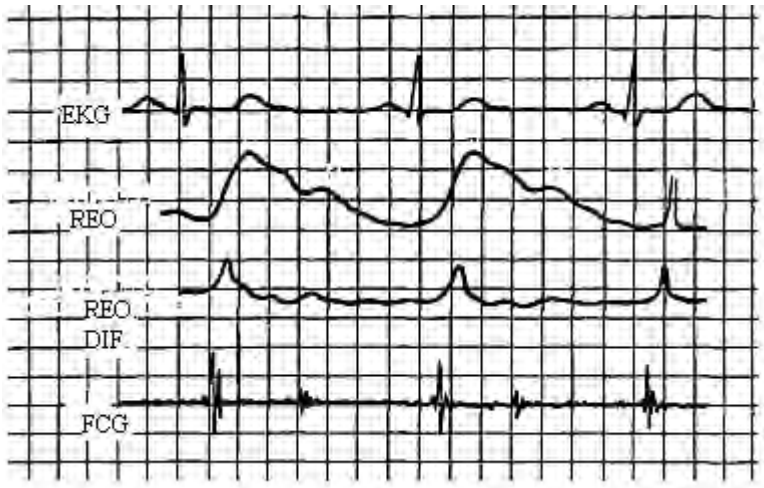


Fig. 2

In a fig. 2 the base signals are presented which characterize a condition of a cardiovascular system, and in the table 1 the parameters are indicated which are necessary are to defined at the first (minimum) level by(with) probing in the block of the express train - analysis. The program

can be a foreseen possibility of a choice such as and functional complexity of the analysis, and also it is necessary to inspect a gang of parameters, which.

Table 1

Indent Parameters and ECG intervals	**Amplitude, m B**	**Duration, s**
Indent		
P	0,1 - 0,2	0,1
Q	(1/4)* R	< 0,03
R	0,6 - 2,5	0,03 0,05
S	0,1 - 0,25	< 0,03
T	0,25 - 1,8	0,25
Intervals		
PQ		0,12 - 0,18
RR		0,8
QT		0,34 - 0,44
Segments		
PQ		0,12 - 0,18
ST	0,05 - 0,2	0,06 - 0,1

Parameters REO of signal	**S**
AC (amplitude)	0,049 + 0,003
IC (incesure)	0,036 + 0,002
T (duration)	0,085 + 0,004

At a choice of element base for realization of such microprocessor system(device) the defining factors are not only characteristics, and cost price of integrated circuits and mutual compatibility of elements of a different type. BMS refer to group of low frequency signals, but for their entry and preservation for a long time it is necessary to have major memory. Therefore as a processor element it is possible to select microprocessors, the elements of a type DDRRAM, RDRAM, PC133 (table 3) are presented in the table2, and for realization of digital memory.

Table 2

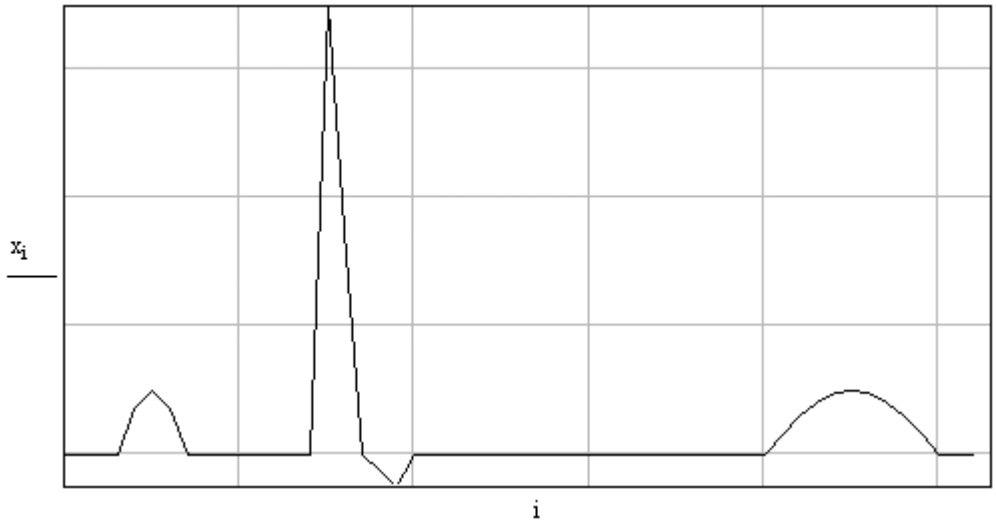
Processor	Frequency of system bus, MHz	Cash memory, KB L1+L2	Frequency range of prose, MHz
TMS320C40 NM 6403		_____	40
Duron	100 (200)	64+64	650 – 1500
Athlon	100 –133 (200 – 266)	64+128	650 – 2200
Celeron	66 – 100	32+128	300 – 2200

Table 3

	DDR RAM, GB/s	RDRAM, GB/s	PC 133, GB/s
Peak channel capacity	2,1	1,6	1,4
Efficiency of bus memory working	65 %	85%	60%
Effective channel capacity	1,37	1,36	1

MODELING EXAMPLE

In a fig. 3 the example of simulation of algorithm of definition(determination) of amplitude - hour and interval parameters ECG- of a signal in a medium packet of applies programs (PAP) - MATHCAD is indicated.



$$FCR := \frac{60}{T_{rr}} \qquad FCR = 75$$

$$Im := \frac{t_p}{S_{pq}} \qquad Im = 1.1$$

$$TQT := \frac{T_{qt}}{\sqrt{T_{rr}}} \qquad TQT = 0.403$$

On the basis of this algorithm the program can be developed which notes in machine-language codes in digital memory of a microsystem for realization of the express train - analysis ECG.

Average level (the level of the expert) provides a possibility of more detailed analysis of biosignals with use the PC and specialized programs for probing cardio-signals and reograms (CARDIO-10, PEO-5), that grants a possibility of realization of the analysis BMS, which were obtained for a particular period, for revealing chronological modifications of signals during time of observation.

Highest level (the level of a consultation) provides a possibility of realization of the complex detailed analysis BMS with use of world data bases and powerful specialized computer programs at diagnostic centres. The information in this case is necessary to transmit through the modem on communication lines with use of the special standards of signaling.

REFERENCES

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MECHATRONIC POSITIONING SYSTEM WITH THE VELOCITY CONTROL

This paper presents a mechatronic system for speed control in non-ferrous continuos foundry machine. This system uses a hydraulic cylinder with inductive displacement transducer, a proportional valve and an electronic module. The moving control uses a positioning closed loop. The electronic block assures position and velocity control and the stop time, too. The cylinder's displacement is cyclical due an automatic programmer that commands the fastening cylinder, too. User can program both directions' speed, stroke and pause time. A smooth starting move is assured by acceleration control.

The electronic control module is placed in case of proportional element. The program unit contains 8 multi-turn potentiometers for setting motions program, start/stop switch and light Indicator of moving status.

1. INTRODUCTION

A typical application of mechatronic systems consists in hydraulic positioning equipment using a closed displacement loop. The authors use such equipment for a control of non-ferrous continuos foundry machine.

The diagram particularity is to bring the work table in prescribed position, with a speed prescribed too, in a preordain time. The module described in this paper is so conceived to control two thus commands. The speed control is obtained with voltage controlled ramp generator. A sequential programmer provides the cyclic displacement command. Between this two movements exists a necessary pause to operate a hydraulics system of material catch. The displacement control function is the following: an error amplifier compares all the time the voltage which represents displacement with a reference voltage *Ui* which represents the reference size. As long as the two voltages are different, the error signal ΔU commands the hydraulic element so that it decreases error to zero to obtain a position equal with the prescribed one. Because at conception and execution of this system there were taken stability measures, it is obtained a precise operate of the system.