# MULTIFUNCTIONAL DEVICE FOR MONITORING HUMAN VITAL SIGNS

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Annotation. Development of the device for monitoring human vital signs requires programming of software part.

In modern society, more and more attention is paid to human health. In connection with this, recently a number of wearable devices have appeared on the consumer market, which have the ability to perform evaluation measurements of the parameters of the human body. Thus, the relevance of this work is conditioned by the needs of the worldwide market of portable electronics.

The relevance of this work is that there are very few wearable devices on the market that determine blood pressure and ECG, and present the received information in a convenient form. Also, the data obtained are used raw, without any additional analysis.

The purpose of this work is to design software for a multifunction device that will not yield to competitors of the highest class, and even exceed them in some parameters. The device for monitoring vital signs should record the basic characteristics of the human body, in particular, the saturation of blood with oxygen, as well as the number of heartbeats.

In order to program a microcontroller, it is required to write a program code for a specific type of microcontroller, in our case it is STM32F103. Absolute leader in popularity is the integrated development environment Keil Microvision. The main advantage of this program is that it is free.

This software package is in conjunction with the program STM32Cube. This program allows you to assign functions of various outputs of the microcontroller in a convenient graphical interface, as well as configure the peripheral clocking, peripheral power, and the necessary microcontroller performance.

The software architecture of the device for monitoring human vital signs was developed. The main advantage that this system has is that, in fact, the controller begins to have the likeness of multitasking.

Also the register system memory was developed and tested on the debug board. This register system is available from all services of the program code, which provides protection against duplication of various variables and constants, which contributes to saving the internal program memory as well as the microcontroller's RAM.

For some modules (ECG, a galvanic skin response unit), the algorithm of operation turned out to be quite simple, and, therefore, the description of their services was limited to a simple poll of the ADC and adjustment of the electronic potentiometer via the SPI interface.

The necessity and relevance of this work are substantiated, the theoretical foundations of the operation of this device were described, since the physiology of the human

body was the determining factor in this work. Blocks of executable code are designed, a universal program structure for microcontrollers is developed.

## МАТЕМАТИЧЕСКОЕ МОДЕЛИРОВАНИЕ ПРОЦЕССОВ РАДИАЦИОННО-ИНДУЦИРОВАННОГО АДАПТИВНОГО ОТВЕТА И ПОСТРОЕНИЕ ЗАВИСИМОСТИ ФАКТОРА ИЗМЕНЕНИЯ ДОЗЫ ОТ ВРЕМЕНИ

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## MATHEMATICAL MODELLING OF PROCESSES OF RADIATION-INDUCED ADAPTIVE RESPONSE AND PLOTTING OF DEPENDENCE OF DOSE CHANGE FACTOR FROM TIME

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The subject of this research is an analysis of the process of radiation-induced adaptive response, stimulated by low doses of radiation. And also constructing of the dependence of dose change factor from different time intervals.

Радиобиология — постоянно развивающаяся, комплексная наука, которая имеет множество направлений. На данный момент одним из самых спорных и насущных проблем является воздействие «малых» доз ионизирующего излучения и их опасность для человека. Дискуссии также вызывает и количественное определение «малых» доз [1, 2]. Так позитивным эффектом «малых» доз принято называть радиационный гормезис. Одним из его проявлений является феномен адаптивного ответа, который представляет собой универсальную реакцию клеток на облучение в «малых» дозах, выражающуюся в приобретении устойчивости к поражающему действию ионизирующего излучения в «большой» дозе. [1, 3].

Целью данной работы является анализ процесса радиационно-индуцированного адаптивного ответа и построение зависимости фактора изменения дозы от времени.

В качестве «малых» доз обычно принимают дозы до 1 Гр. После облучения такими дозами может наблюдаться повышение устойчивости биологических объектов к экстремальным условиям, а именно повторное воздействие большими дозами ионизирующего излучения. Изменение выживаемости после облучения и является критерием адаптивного ответа. При этом интервалы времени между воздействиями являются фиксированными [2].