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USING A MOBILE CARDIOGRAPH CONNECTED TO CLOUD TECHNOLOGIES FOR HUMAN CONDITION MONITORING

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Identifying the underlying causes of palpitations and other arrhythmia-related symptoms is of great clinical importance. Registration of heart rhythm directly during the onset of symptoms by long-term ECG monitoring is a known method for identifying their cause in patients [1, 2]. ECG monitoring is an important diagnostic method for correlating symptoms and heart rate. The development of modern technologies has provided a wide range of devices for ECG monitoring, which differ in the duration of monitoring, signal recording quality, convenience and invasiveness.

In addition, it should be borne in mind that Holter monitoring (HM) is widely used in various clinical settings to diagnose arrhythmias and conduction, which can't always be detected by a standard electrocardiogram (ECG). CM allows to establish the relationship of clinical symptoms with cardiac arrhythmias and conduction, to assess the effectiveness of anti-

arrhythmic therapy, the patient's response to its correction or cessation, allows to assess the prognosis in specific clinical situations. Accurate and timely diagnosis of arrhythmias is a determining factor for a correct diagnosis and is crucial for effective treatment.

Currently, HM is a relatively inexpensive, affordable and easy to perform method. Modern devices used for CM are light, invisible and practically do not cause discomfort to patients when wearing. The function of continuous ECG monitoring «beat-to-beat», automatic arrhythmia detection and wireless data transmission in real time have become important factors determining the high diagnostic efficiency of the method and its ease of use [3, 4]. Therefore, the aim of this work is to create preconditions for long-term use of mobile diagnostic devices for monitoring the patient's condition on the basis of ECG using wireless interfaces and cloud storage to solve a set of technical and economic problems of early detection of heart rhythm disorders.

Diagnosis of some cardiac arrhythmias is a non-trivial task. It is very difficult to record rare episodes of arrhythmia in real clinical practice [5]. Holter electrocardiogram monitoring only partially solves this problem, because: standard HM is the average duration of ECG recording in 1-2 days; multi-day HM has a high level of discomfort caused by numerous wires and a mass of equipment, as a result of which patients may interrupt the study prematurely.

The use of modern implanted recorders allows to record electrocardiographic events for a long time – from 2 to 3 years, but invasive implantation of such devices is a deterrent for many patients. The financial component of the issue is also important: the price of such a recorder and its implantation ranges from 1 to 3 thousand dollars, which is also a barrier to its widespread use. Therefore, currently an increasingly important task is to develop a system that will provide non-invasive fixation of the ECG signal over a long period of time.

Analyzing the above data, we can conclude that the main problems of devices of this type are:

1. Large mass and size parameters.
2. Inconvenience and low speed / frequency of data transmission.
3. The presence of conductors for connecting sensors and batteries.
4. The absence of a sufficiently large built-in storage device, which does not contradict the requirements of paragraph 1.

The solution of these problems can be based on the results of modern technological development of all branches of electronics, namely the development of wireless communication technologies, minimization of per-

manent storage devices based on programmable memory (EEPROM) and the use of cloud storage for data transmission and sharing obtained from the patient.

Therefore, currently in demand will be systems that have the advantages of non-invasive fixation, duration of ECG signal registration and ease of use, primarily due to the compactness of the device and the ability to independently control registration (possibility of intermittent ECG signal recording, stop recording for a while with subsequent self-renewal) [5, 6].

Therefore, there is a need to implement a parallel channel, which would be included based on an objective analysis of ECG data. However, this requires a preliminary analysis of the current ECG data obtained directly from the cardiac monitor placed on the patient before transmitting it through an external communication channel. And this raises the second question that arises before the developer of the equipment, how to implement this analysis, without a significant deterioration in the mass and size of the devices placed on the patient. The solution to this problem is to supplement the cardiomonitor with an ECG analyzer according to a simplified algorithm, which would respond only to certain changes in the structure of the ECG teeth. Schematic implementation of such a simplified analyzer will not be complex and dimensional enough. Examples of variants of such a simplified analysis are presented in [7–10].

Rapid advances in modern technology and the expansion of physicians 'and patients' access to ECG equipment and computer programs provide great opportunities for diagnosing both symptomatic and asymptomatic cardiac arrhythmias and conduction disorders, which can cause a variety of patient complaints of malaise and life-threatening health conditions. However, the use of XM-ECG methods has a number of limitations [11–13].

Portable XM-ECG devices in the near future have every opportunity to become a new standard of outpatient diagnosis for the detection of arrhythmias and cardiac conduction disorders. However, HM-ECG can be important for medicine not only in the field of diagnosis, but also for patient follow-up, influencing both short-term and long-term treatment results. As a result, we can expect an improvement in the quality of diagnostic and therapeutic care for patients in general.

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