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Monitoring the Physiological Parameters of Patients with Non-Communicable Chronic Diseases

Victor Sontea[1], Vladimir Vidiborschii[1], Valeriu Palii[2]
[1] *National Center of Biomedical Engineering, Technical University of Moldova, Republic of Moldova*
[2] *Holy Trinity Municipal Hospital, Chisinau, Republic of Moldova*

In the Republic of Moldova, non-communicable chronic diseases account for approximately 90% of all deaths, with 59% attributed to cardiovascular diseases. A major cause of this high morbidity in contemporary society is the lack of continuous, effective, and remote monitoring of physiological parameters that affect people's health and daily activities, leading to difficulties in the prompt and adequate implementation of recovery measures. This can transform these physiological dysfunctions into pathological conditions. Therefore, remote monitoring of the health status of patients with non-communicable chronic diseases through the effective exchange of medical information between patients and doctors is essential and can contribute to reducing the mortality rate.

Remote monitoring of the physiological state of the body is considered one of the most effective ways to address this issue and enables the rapid organization of healthcare to maintain health. The successful implementation of telemedicine services can also extend cost-effective access to medical services in rural or isolated areas, making a strong case for the adoption of e-medicine in the Republic of Moldova, especially in rural areas.

Physiological parameters monitored for the preventive health status of the human body include the heart rate, respiratory rate, blood pressure, body temperature, and blood oxygen saturation.

The developed multiparametric device for remote monitoring of physiological parameters of patients with non-communicable chronic diseases consists of a multiparametric monitor and an analyzer of gas and volatile compound concentrations in exhaled air (carbon dioxide CO2, oxygen O2, acetone C3H6O). This device comprises the following modules:

- The central module, based on a microcontroller, equipped with an information system for data collection and transmission to the screen of a mobile phone.
- Radio/WiFi communication module.
- Power controller.
- Module for analyzing human parameters (SpO2, heart rate, pulse, electrocardiogram (ECG), blood pressure, temperature).
- Bluetooth, WiFi or GPRS communication module.

To evaluate the device's performance, specialized software has been developed, including a set of applications:

- NIBPTEST-English-v1.2 for measuring blood pressure and pulse.
- ECG View v1.0 for measuring other parameters.

The technical characteristics of the multiparametric device determined through testing include a pressure measurement range of 20 to 270 mmHg, pressure measurement accuracy of ±3 mmHg, resolution of 1 mmHg, SpO2 measurement range of 0 to 100%, accuracy of ±2%, pulse measurement range of 30 to 250, accuracy of ±2 beats per minute, ECG accuracy, and more.

Additionally, the device for monitoring gases and volatile organic compounds in exhaled air has a significant impact on diagnosing metabolic diseases such as diabetes and renal failure by analyzing the concentrations of gases and volatile organic compounds in patients' breath. This device can analyze the concentrations of oxygen O2, carbon dioxide CO2, and acetone C3H6O, which have been identified as biomarkers for certain conditions. The device is compact, ergonomic, and powered by a Li-Ion battery, providing long-lasting functionality.

This analysis of human breath represents a non-invasive method for detecting metabolism-related diseases such as diabetes and renal failure. The sensors used are sensitive to very low concentrations, making the device cost-effective. This device can be particularly useful in medical institutions for the development of non-invasive remote diagnostics.

In conclusion, this paper and the developed devices have a significant scientific, social, and economic impact by improving access to medical services, early disease diagnosis, and reducing the mortality rate, especially in rural areas.

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