

Scientists have created a device for remote diagnosis of heart condition

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Researchers at the National Research Lobachevsky University of Nizhny Novgorod (UNN) have developed a software and hardware system to remotely assess deviations in heart activity and identify cardiovascular diseases at an early stage. The CyberHeart intelligent supercomputer technology is designed to serve both patients and cardiologists.

The CyberHeart software and hardware system is intended for creating an automated telemedicine network. The scientists' task is to create a system for remote cardiac monitoring, a round-the-clock service that could assess the state of the patient's cardiovascular system. The plans are to develop a line of home appliances for taking cardiograms, automatically transmitting them across any distance via [mobile communication networks](#) and receiving a medical conclusion. To operate such devices, no special medical skills will be required.

The system consists of several sets of equipment and devices. For medical institutions, for call centers that receive signals, and for ordinary people. The devices can be included in the family medicine chest just like a blood pressure monitor. With the help of such devices, users can check the heart condition and transmit the cardiogram data to the hospital. The [device](#) is quite small and fits into the palm of an adult person. To take the readings, it is attached to the person's chest.

Miniature mobile cardiographs exist in different configurations: for medical institutions and for private use. They can diagnose [heart rhythm disturbances](#) and provide feedback from the doctor. The device can be

equipped with a display for providing the user with an instant diagnosis.

"We take an electrocardiogram, automatically decode it and transmit the data to a smartphone. It allows you to identify some emergency states of the cardiovascular system. For example, in case something is suddenly wrong with the heart, a red light signals the trouble," explains Dr. Grigory Osipov, Head of Department of Control Theory and System Dynamics at the UNN Institute of Information Technology, Mathematics and Mechanics, who is heading the project.

The device has three indicators: green, yellow and red. The green one means there is no reason to worry, the yellow indicates suspected disorders and recommends to visit the doctor, while the red one signals that urgent medical aid is required.

"A cell phone can send a signal to our supercomputer that will process the data and give a more extensive diagnosis. This system is designed for public at large. When you are in an area not covered by a mobile phone network, your smartphone will still be able to detect an emergency situation. And if you need an in-depth diagnosis, you can later send the signal from your cell phone to the supercomputer," the developers say.

The device can work either independently or in connection with a smartphone, it can also transfer the data to a supercomputer. The whole procedure—receiving the data and transmitting it to medical professionals—takes about 10 seconds. The data are transmitted not only to smartphones, but also to supercomputers that can be installed in a hospital or at a specialized call center operating around the clock.

"Doctors at the remote cardiac monitoring center will be able to analyze cardiograms in real time and, if necessary, call an ambulance, contact local cardiovascular medical centers and so on. The CyberHeart system also includes cardiographic equipment of some famous brands like

Schiller. We have our own information system, which is integrated with the all-Russian unified medical information system E-GIS," says one of the system's developers Alexander Nikolsky, who is a cardiovascular surgeon at the city hospital No.5.

According to the researchers, the accuracy of their portable electrocardiograph amounts to 95 percent, while one of the best cardiographs made in Switzerland gives only 80 percent of correct diagnoses. Currently, two systems with electrocardiographs and supercomputers are operating in a large hospital and at the cardiac center of Nizhny Novgorod, and a special cardiology lab has been set up at Lobachevsky University.

The CyberHeart includes methods for reconstructing and modeling [heart activity](#). It provides for an in-depth analysis of the cardiogram, which is based not only on the data of the cardiogram itself, but also on the results of echocardiography, MRI and CT of the heart. Thus, heterogeneous medical data can be additionally loaded into the system for analysis. Once the entire system is certified (which is expected by the end of 2018), it will be possible to launch mass production.

Provided by Lobachevsky University

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