

## DEVELOPMENT AND IMPLEMENTATION OF SMALL WIRELESS ECG DEVICES

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**Annotation** - This article focuses on the development and production of a small, expanded, affordable, and remote ECG device.

**Key words:** electrocardiograph, electrode, microcontroller, Bluetooth module.

Heart disease is one of the leading causes of death. Therefore, early detection of symptoms of heart failure is very important in increasing the patient's survival rate.

Since the ECG signal has showed to contain important information for the diagnosis of heart disease, it has become a primary tool not only for cardiologists but also for all types of hospitals for the diagnosis and treatment of cardiovascular disease in humans. Currently, single or multi-channel ECG applications are widely produced for platforms of computers, tablets, smartphones, smartwatches, and other types of gadgets.

One of the remarkable developments in the field of medicine in the twentieth century is the ECG device. ECG devices have used as an effective tool for visual observation of changes in the cardiovascular system of humans, assessment of changes, and the detection of various types of heart disease.

As well as, the capabilities of ECG devices manufactured abroad, available for sale and tested in research studied effectively. A small, inexpensive, portable electrocardiograph (ECG) and a smartphone ECG application have developed. The level of noise in the smartphone ECG device effectively reduced: the interpretation of ECG signals simplified as a result of the analysis performed using a special medical application and device software.

In the development of the ECG device, attention paid to wireless work with the smartphone and the small size of the device, Figure 1.

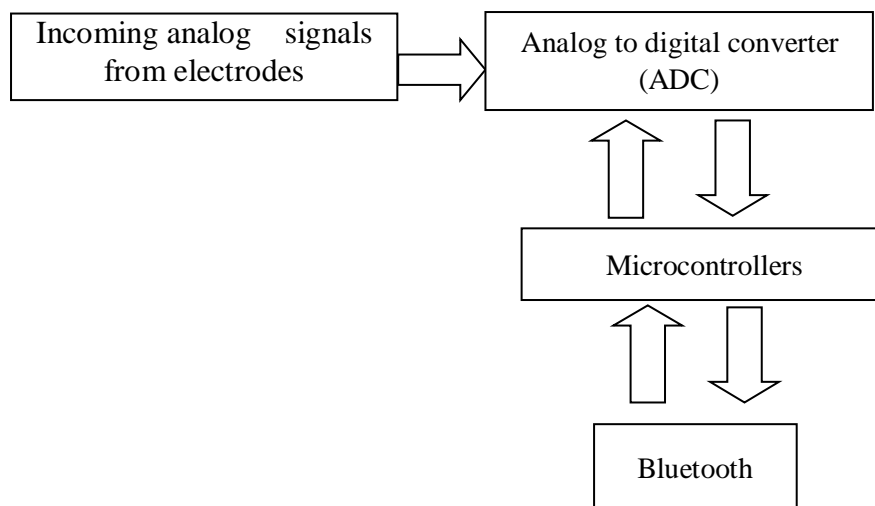


Figure 1. ECG device

The proposed ECG equipment consists of four main parts: they are electrodes, ARO, microcontroller and HC-05 Bluetooth module, Figure 1.

ECG sensors (electrodes) are adapted to place on the surface of the skin, through which the potential difference in small volts is measured. By processing the signals from the sensors, they can visually observed on the screen. The ECG device used 10 electrodes (only eight of which serve to receive ECG signals). The placement of the electrodes across the body performed as shown in Figure 2: right arm (RA), left arm (LA), left leg (LL), right leg (RL), and six chests (V1-V6), as shown in Figure 2. It should be noted that the placement of electrodes in the muscular part of the body increases the level of interference, and in the non-muscular part of the body increases the level of signal quality.

When designing a multi-channel ECG device, it is important to select the appropriate ARO chip to convert the analog signal set to digital.

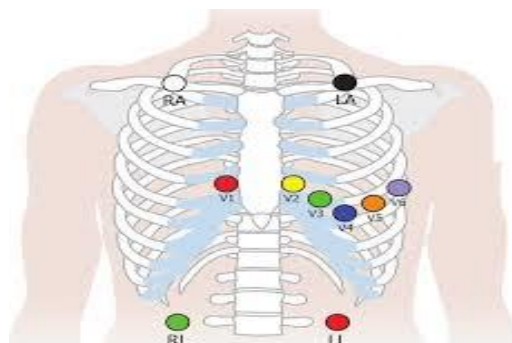


Figure 2. The placement of electrodes in the body

Atmega16 microcontrollers are used in the ECG device to control the process of data acquisition, processing and transmission of data from sensors, as well as other peripheral devices. Bluetooth HC-05 is a module that connects an ECG device to a smartphone and exchanges data over a series of wireless connections.

Almost all ECG devices owned by the Ministry of Health of the Republic of Uzbekistan and used in private medical institutions are imported from overseas. Such devices imported to the Uzbek markets are mainly designed for stationary cases, and mobile wireless multi-channel ECG devices are almost not available for sale, they are usually delivered on a special order basis.

The proposed 12-channel ECG device is used not only in all institutions under the Ministry of Health, but also, if necessary, for independent users to use at home and in sports. It is also possible to improve this device and develop it as a daily holter.

Most importantly, with the development of a standard ECG device and software for smartphones, ECG users will be able to send real-time data to the doctor remotely, and on the basis of this information, doctors will be able to make decisions and diagnose diseases. In addition, the results of this work can be used in the development of a mobile fitness platform in recent future.

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