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GET A 12-CHANNEL EKG USING AN AD8232 SINGLE-CHANNEL EKG DEVICE

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Abstract
EcG instruments measure the electrical activity of the heart muscle to determine the state of the heart. The quality of the ECG signal is a key factor in the detection of heart disease. This work will take a 12-channel EKG of the AD8232 single-channel portable EKG device. This one-channel EKG device with a 12-channel EKG collection technique makes it possible to diagnose the ECG much more conveniently.

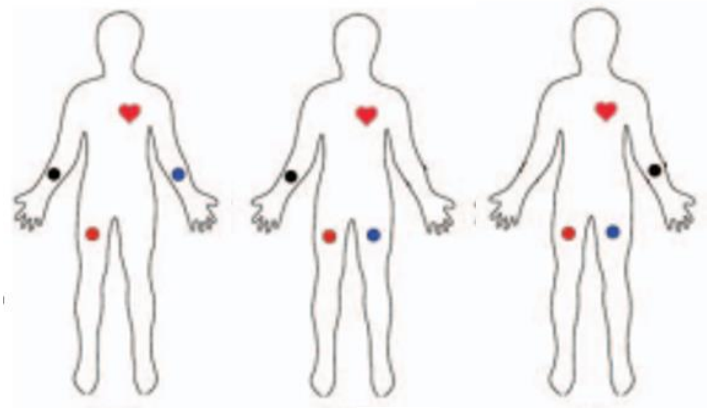
Keywords: 12-channel EKG, EKG, QRS, Arduino, Diagnostics, AD8232.

Introduction

Today, heart disease is one of the main causes of death around the world. It is important to make an early diagnosis in order to avoid severe heart attacks. One of the methods of diagnosis is electrocardiogram. The ECG devices record an electrical signal that comes from the heart muscle, indicating changes in the heart.

Currently, existing ECG devices are mainly located only in hospitals. A patient with a heart attack should wait for an ambulance to arrive and deliver it to the hospital. While waiting for an ambulance, an important signal associated with a heart attack can be reduced, leading doctors to lose track of heart attack causes.

Therefore, it is very important to develop portable EKG devices. Compact devices can be used not only in medical centers, but also as portable medical devices, allowing you to place them even in the home. The diagnosis will also be much easier. A patient with a heart attack can carry this portable ECG device with him. You can also get a 12-channel ECG using a single-channel EKG. To obtain a 12-channel ECG using the AD8232 device, you will need to place the positioning of the electrode as shown in Figure 2.4.



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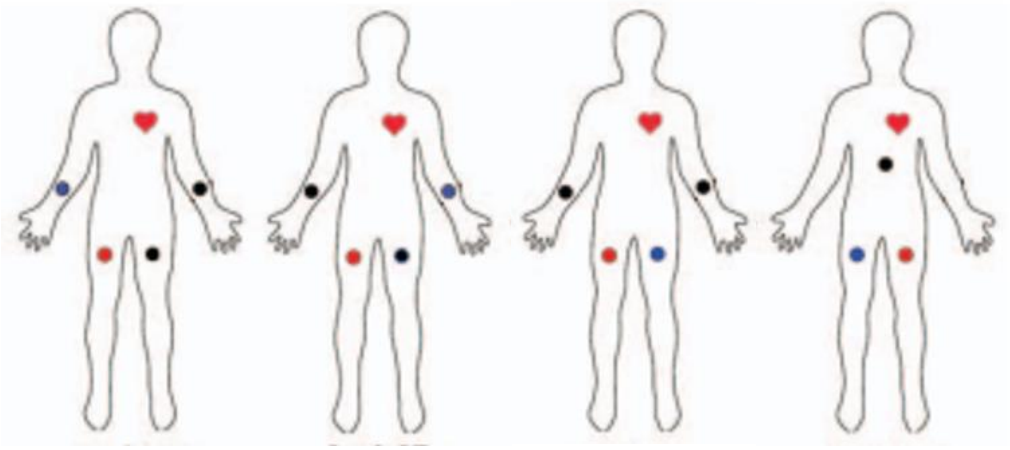

2.4-rasm. Electrode placement views

Chjanpeng Jin [1] recent EKG studies on the Android system, such as HeartToGo, are able to identify peak R and calculate heart rate. The system is also capable of detecting sinus bradicardium and ventricle palsy. Harry Cailanto [2] the mobile EKG device developed by combined Android with the server to store EKG data and provide internet transmission. Determining QRS and arrhythmia is the functionality of the mobile ECG. However, these two research studies are limited to only one-channel ECGs.

In this case, we design an EKG device capable of receiving a 12-channel ECG signal. The device is implemented using a single-channel EKG AD8232. This makes it possible to obtain a twentieth-channel ECG with uni-channel AD8232, which helps in the early diagnosis of various diseases.

Characteristics of the ECG signal

Before receiving the technical signal, we will consider the properties of the ECG signal.

The ECG signal consists of a high total voltage and low amplitude signal placed on the noise [3]. The total voltage is caused by electrode-skin conversion and can reach 300 mV. The amplitude of the EKG signal itself has a frequency content of 0.05–100 Hz with a frequency of 0 –3.0 mV. The interactions that may occur in ECG signals are caused by:

Power grid noise at 50 or 60 Hz of harmonics

Electrode noise caused by skin-electrode contacts, amplitude 300 mV in constant token signal

Muscle contraction due to patient movement

The main noise caused by the patient's breathing, low-frequency variable token signal

Electromagnetic noise from other electronic devices is usually in high-frequency signals

Specification of technical

Rachit [4] According to it, the ECG bandwidth specification depends on its application. Bandwidth Specification 2.Table 1 quoted.

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Table 2.1 ECG application and its frequency conductivity

Attachment	**Frequency (bandwidth) (Gts)**
Show	0.5-40
Define QRS	0.5-40
Determination of arrhythmia	0.05-60
ST Segment Tracking	0.05-60

In this case, the EKG device is mainly used for display and QRS detection. This means that a bandwidth of 0.5-40 Gts is selected. Four electrode systems are used to obtain enhanced channels. See table 2.2 for full specifications.

Table 2.2 ECG device specification

Parameter	**Value**
Attachment	Define & Show QRS
Channel	One-channel
Read Channel	Up to 12 channels with 4 electrodes
Bandwidth	0.5-40 Gts
CMRR (common mode rejection ratio)	80 dB
Resolution	Better than 5 mkV
Growth	More than 1000 V/V
Sample Frequency	Faster than 250 samples
Input Voltage	5-12 V
Connect	Seriyali cable

System Design and Application

As mentioned in Table 2.2, to solve all specifications, we design the apparatus using a step-by-step method.

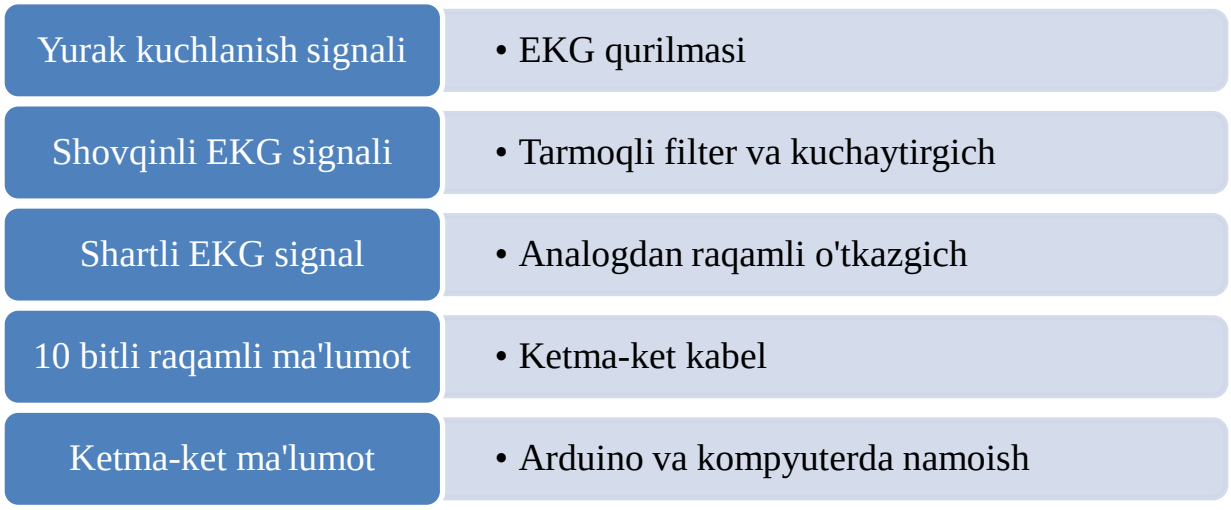

Figure 2.5. EkG Device Functional Blog

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Table 2.3 ECG Device Block Description

Module	**EKG Device**
Log in	Heart voltage (0.01-250 Gts, 0-3 mV)
Exit	Serial ma'lumot
Function	Convert heart voltage (filtering, amplify, digitizing) into sequential data to be sent to a computer

The ECG signal from the patient is first obtained using three electrodes for all channels except the extended channels, and for the rest of the channels (V1-V6 channels), we use one additional electrode. The tape filter and amplifier are made using the EKG device. The microcontroller controls the transducer conversion from analog to digital and transmits digital data to the computer using a serial cable. Getting an EKG is carried out in the following sequence.

• The electrode is performed using a gel electrode. Even if the gel electrode is one-time, it is cheaper and more convenient to use. Another type of electrode, for example, a clamp electrode, is more expensive and for better conductivity, an additional gel is needed.

• For microcontrollers, we select a 10-bit ATMega on the Arduino Mega 2560 plateau. Connecting to the computer is carried out using the Arduino series cable.

Table 2.4 Network filter and amplifier block description

Module	**EKG Device**
Log in	Heart voltage (0.01-250 Gts, 0-3 mV)
Exit	EKG signal 0-3.3 V, 0.5-40 Gts
Function	High-frequency and low-frequency component filtering >1000 V/V Voltage Increase Common mode signal rejection

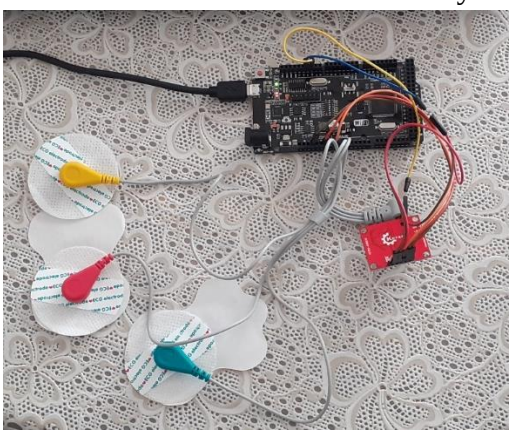
The bandwidth filter and amplifier is the use of a device amplifier and operational amplifier cascade. The tool amplifier has continuous token rejection and differential amplification characteristics, which makes the tool amplifier acting as a highly conductive active filter. In the second step, an operational amplifier is performed to achieve a low-frequency active filter. There are a number of analog ECG interface modules on the market. Multiple Modules Comparison Table 2.5 quoted [5][6][7]

Table 2.5 Comparative analysis of ECG devices

Parameter	**Devices**		
	Ad8232	**HM301D**	**ADS1191**
Company	Analog Devices	ST Microelectronics	Texas Instruments
CMRR	80 db	100 db	95 db
Exit Impedance Resistance	10 GOm	50 MOm	100 MOm
Growth	100 V/V	64 V/V	12 V/V
Feature	Get a 12-channel ECG from a 1-channel EKG (by replacing the location of electrodes)	3 kanalli EKG	Low noisy programmable growth amplifier and high-precision analog digital modifier
Price	$19.21	$125	$7.96

AD8232 is better than other devices. HM301D is a three-channel device. ADS1191 doesn't bring a high enough quality result to get a good resolution. AD8232 has the best output resistance and quality performance. High and low-conductive filter structures are listed in the AD8232 data table [5]. For the upper pass filter, a two-packed high pass filter and two-box Sallen-Key low pass filter are used for the low pass filter. AD8232 has an EKG plate of 0.5-40 Gts. Using this built-in board, we make active filters.

JEHOVAH'S WITNESSES Would Be Pleased to Use the "Bicycle".See figure 6.



2.6-rasm. AD8232 EKG device and Arduino Mega 2560

The Arduino IDE is used to program the microcontroller because the programming language to be written in it is much easier and more convenient and can be integrated with other programming languages through a serial port (integrated with C# programming language in this work). The application in the microcontroller is used to identify the channel and send data. In the next phase, the software on the personal computer was created. In this application, show a graph of incoming data through Arduino, write to a file *.txt and send the data to the server in JSON format.

In the third phase, a computer program attached to the server can see EKG data in the provider's section, and also allows you to process incoming data to the signal using delta functions and see in it changes in the sectors of the EKG as examples of numbers and to store the results by sending them to the server.

Data transfer. Data transfer gives a very specific signal (see figure 2.7).

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2.7-rasm. Natja from the EKG device

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So it was possible to get a 12-channel ECG using a single-channel EKG. This prototype was designed and tested for standard clinical ECG. The EKG obtained via this device has a similar shape with the EKG form obtained from multi-channel devices.

The ECG signal received through the AD8232 EKG device is stored as a .txt file that meets the MIT-BIH standard. The signal is processed through the C# application and sent to the server in JSON format. 12-channel ECG processing allows early detection of various heart abnormalities[8][9][10][11][12][13].

Summary

This work carried out the acquisition of a 12-channel ECG of the AD8232 single-channel portable EKG device. This one-channel EKG device with a 12-channel EKG collection technique makes it possible to diagnose the ECG much more conveniently.

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