Portable ECG Monitoring System Using AD8232 (IoMT)

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Abstract- The continuous improvement of Mobile ECG monitoring requirements this document provides a practical solution for the Mobile ECG monitoring system. The monitoring terminal is designed for, using AD8232 to realize ECG signal collection and amplification. And AID conversion. The built-in Node MUC with WI-FI is also used. The system has the function of monitoring Terminals to transmit ECG data to a web app. Due to the characteristics of low power consumption, small size and high reliability, this design can be used in Family medical care and community medical care.

Keywords – ECG Monitoring, web app, AD8232, Wi-Fi, Online Date Streaming, Real-time Monitoring

I. INTRODUCTION

Medical expert systems are added every day, part of which is wearable smart Healthcare equipment that can be used in daily life. In this rapidly developing and highly competitive world, medical applications are gaining greater importance. Any changes in heart rate or rhythm, or changes in Morphological ECG signal patterns are symptoms of cardiac. Arrhythmias can be identified by analysis of stored. ECG data The ECG Monitoring System plays an important role in identifying heart disease. Researchers are working on documenting Long-term ECG monitoring systems. Several types of ECG measurement systems have been introduced. ECG The monitoring systems currently used in Hospitals are large and heavy, so they are not very portable, and the Measurement system has 12 electrodes, of which 2 are on the ankle strap 2 are on the wrist, and the other electrodes are on the chest. These electrodes are Gel electrodes, which may cause allergy and infection when used frequently, so it is not easy to make measurements long term. The devices are expensive and the doesn't allow for home monitoring, so older people who need regular heart rate checks Struggle with large populations, which is a major problem. The hospital checked the ECGs of all 4,444 patients for the problem. To provide a home monitoring system, Smart technology plays an important role in which the Results of collected ECG data are analyzed and shared with doctors and family members. Several apps provide various health-related data, such as electrocardiogram, finger photoplethysmography, and blood pressure plethysmography there are several gain filtering methods of the Signal used to achieve the correct Waveform. The delayed signal error is normalized using LMS to achieve high speed and low latency and uses the SVM Classifier method to remove noise. The Signal analysis depends on the P, Q, R and S points in the ECG signal waveform, the detection of these points has various Algorithms, which are implemented on the IOS-based web application to serve people in remote areas. Can access data from the cloud and provide detailed analysis of the various data collected. Therefore, Noise suppression is performed using FIR and FFT filters. The ECG monitoring system can also be designed to be Remote as part of its private home network, which is more reliable than the home monitoring system. Many devices detect ECG signals, and these electrodes are used in Textiles, seat belts, watches and Cell phone cases. The signal is controlled by the controller and sent to the Cloud; in this investigation, they use the ESP32 Microcontroller to control the signal. By comparing the raw ECG signal with the output of different Filters, they calculated the Power spectral density and the signal-to-noise ratio before and after Filtering. Many Sensors in the market can detect ECG signals, such as wireless Sensors, MEMS and nanotechnology are developing Different types of wireless wearable sensors for better service life. The commands are used to make it possible to send and receive data from the cloud. This process is implemented Via the HTTP and MQTT protocols. Since Smartphones have limited power consumption and are very portable, transferring Heart rate data to smartphones requires a lot of Ability to deliver Mobile applications to all operating systems. In the introduction, a review of work related to the design of ECG systems is discussed. In the second section, the detailed system architecture and the application are discussed. The third section presents the steps for reading

ECG data through electrodes for the analysis and design of Mobile applications. The last section summarizes the work of the project with future scope.

II. SYSTEM ARCHITECTURE

The architecture of the ECG monitoring system is shown in Figure 1. It is mainly divided into four Parts, namely:

1. Sensor module

Figure. 1. Basic features in the waveform of an ECG signal.

2. Controller module
3. Web Application.

ECG signals are obtained by placing Electrodes on body parts, these signals are amplified using an AD8232 sensor which uses low power and reduces Noise. The sensor output signal is given to the Analog pin of the Arduino Uno board. The threshold level of heartbeat is set from the acquired signal, so this data is sent To a Web app via Wi-Fi. Based on the Threshold level, the ECG signal of the real-time test displays the result with the heart rate on the Web Application.

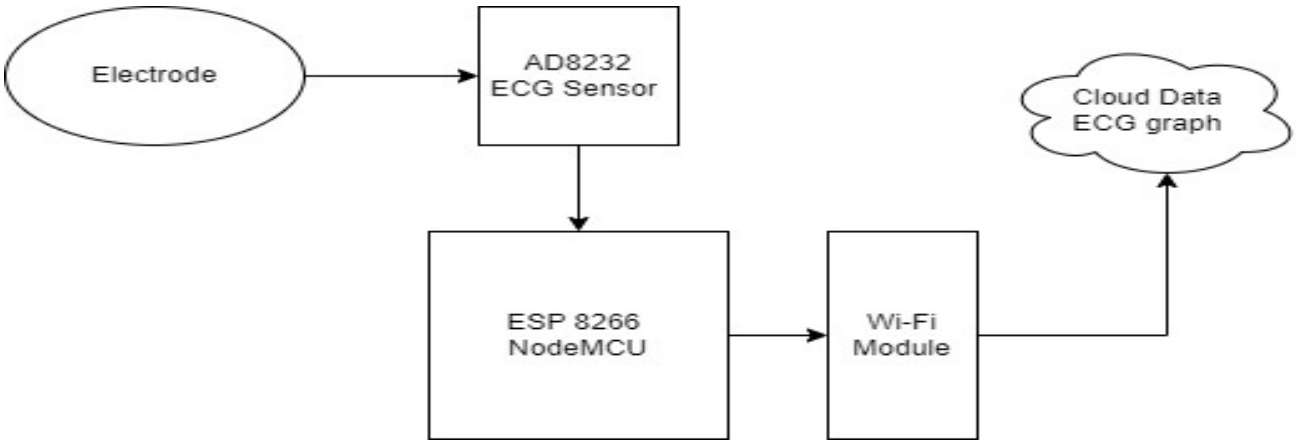

Figure. 2: Block diagram of the proposed system

A. Sensor module:

The sensor module has two parts.

1) Electrodes:

The electrodes used in this project are. Disposable electrodes offer fast, easy, and more hygienic which is. Alternative to reusable electrodes or wet Electrodes. These electrodes are pre-gelled. And these are called dry electrodes. Will be good for the patient skin. Instead of Using 12 lead electrode systems and keeping the bulk device, it's been used 3 leads. Electrode system devices as shown in Figure 2, where the electrodes are placed on the right-hand wrist (R-Red), left-hand Wrist (G-Green) and the right-leg ankle (Yellow).

Figure. 3: Dry electrodes with color code pins.

2) AD8232 ECG Sensor:

This little chip is called. AD8232 measured the heart rate. Figure 3 shows the Sensor module, it is harmless, it Measures heart rate and gives a Signal, it can be directly connected to any Controller like AESP 8266, or Raspberry-pi. The sensor is designed to pick up the Signal even when the Electrodes are not in good contact with the body. The signal extracted by the Is is then amplified. This Design allows the Output signal to be easily obtained from an embedded controller device or an Analog-to-digital converter (ADC) ultra-low power device.

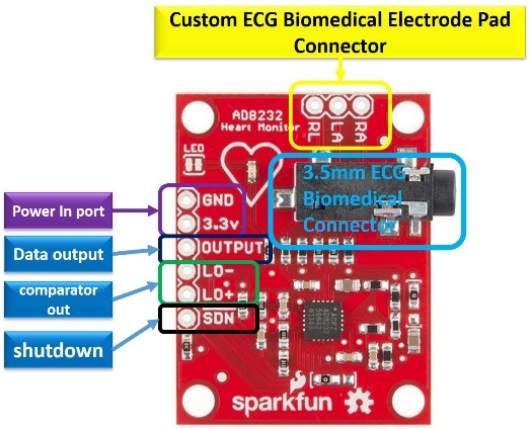

Figure. 4: AD8232 Sensor.

The AD8232 is a cohesive front end for Signal acclimatizing of heart bio potentials and for heart rate monitoring. It consists of a particular instrumentation amplifier, a Right leg drive amplifier, an operational Amplifier, and a mid-supply reference Buffer. In addition, the AD8232 contains. This leads to recognition circuitry and an automatic fast recovery circuit where that restores the signal soon after the is reconnected. The AD8232 consists of a dedicated instrumentation amplifier, that amplifies the ECG signal, and the electrode half-cell performs latency suppression at the same stage. This indirect current feedback architecture of that can be achieved by reducing the size and power of the compared to traditional implementations. The figure shows the pin configuration of the AD8232 sensor.

B. Controller module:

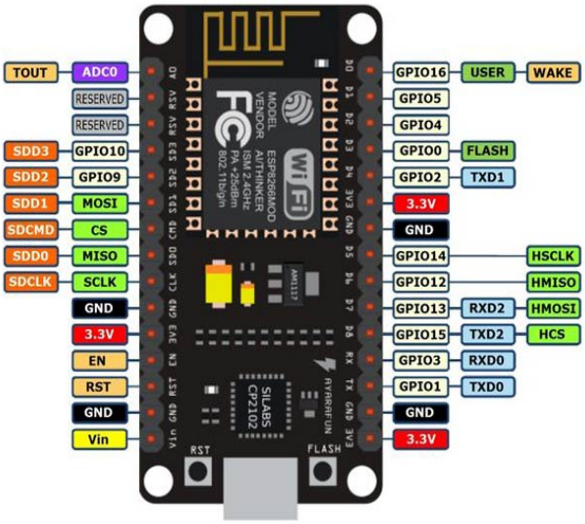

Figure. 5: ESP 8622 Module

The ESP8266 uses a 32-bit processor with 16-bit instructions. It is Harvard architecture which mostly means that instruction memory and data memory are separate. The ESP8266 has on die program Read-Only Memory (ROM) which includes some library code and a first-stage boot loader.

III. DESIGN OF WEB APPLICATION

The project is divided into two parts in the software, the first part is to control the ECG signal extracted by the Sensor, and the second part is to send the data to the mobile phone. Originally the ECG signal was obtained from the AD8232. And the sensor was converted to digital data using ESP 8266. Board. The voltage-converted serial data collected via the USB is received and displayed on the screen. The C program is written to filter noise without losing important data in the ECG waveform. The Serial Plotter software is used to plot the ECG waveform on the Monitor as shown in Figure 6. The web application is developed using Java. Programming language which has a built-in Library for Wi-Fi connection. Compares the filtered signal from the ESP processor to the thresholds and displays the status of the Patient. The application before connecting to the Wi-Fi. The Web application display window with patient results.

The working step is to monitor the ECG signal.
The app is as follows:

Step 1: Place the electrode on the wrist and the anklet. Based on the color code.
Step 2: ECG signal acquired through the electrode is read.
Step 3: Establish a connection between the Webs.

App and connect the Hotspot with mobile internet.
Step 4: Run the code to analyze the signal.
Step 5: ECG signal is displayed with the help of Arduino software.
Step 6: Simultaneously the heart rate displayed in Mobile application.

IV. RESULT AND DISCUSSION

ECG Sensor uses the AD8232 high-performance. Integrated chip as the front end instead of the traditional discrete components and adopts the Dual-core system. The main choice reflects the characteristics of portability. Analyze the characteristics of ECG, ECG automatic analysis can be divided into signal quality detection, Filter design, QRS complex detection, and arrhythmia detection. This article introduces the main processing methods and finally chose the appropriate algorithm to apply to ECG index1. Subjects will learn about their heart health while lacking knowledge due to the heart health index given by ECG Sensor. This matches the trend of Home medical equipment.

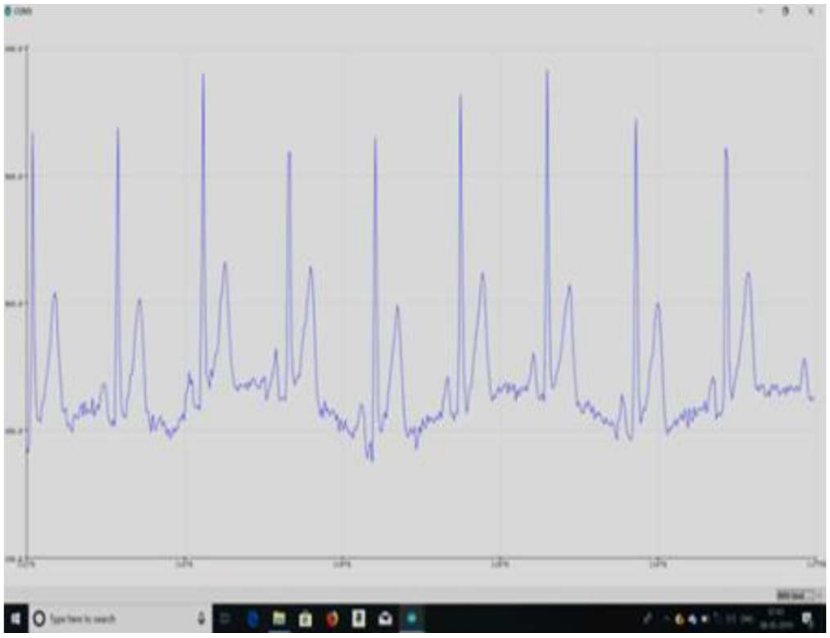

Figure 6. ECG waveform

V. CONCLUSION

In this project, we design and implement smart technology related to Medicine for remote areas and home use, monitor ECG signal and display. Heartbeat in real-time. Three Portable monitoring electrodes provide satisfactory real-time accuracy. This data is. Filtered and sent to the mobile application. Further research Aims to obtain the time between R-R intervals and to analyze different heart problems by increasing the level of precision of the Signal using the C code in the Arduino software. The future scope of this Project is to develop an efficient algorithm for a long. Analysis and can use Wi-Fi technology to improve the data transmission of signals.

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