Android Platform based ECG Arrhythmia and Heart Rate Analysis

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ABSTRACT

The rapid growth of the medical technologies and constant renewal of medical facilities, electrocardiography (ECG) provides an effective and easy to use means for arrhythmia classification and heart rate variability (HRV) analysis. Most of the existing ECG device have the disadvantage of poor local signal processing ability. After thorough investigation, Android platform is adopted to develop an ECG signal processing application for real-time arrhythmia classification and HRV analysis. The ECG data acquired are transmitted to the Android smart phone or tablet via Bluetooth. ECG simulator is connected to signal conditional unit. The received analog signals are converted to the digital values and then passed to the microcontroller. From the microcontroller data will be transmitted with the help of Bluetooth and it will be received from the mobiles phones. Android application for interface with ECG kit for monitoring patient health status is created. For this process, first Bluetooth connection with ECG Bluetooth device is established, once the connection is success, data from established connection is received through mobile phones.

Keyword : - *Electrocardiography, Arrhythmia, ECG, Simulator and HRV etc…*

1. INTRODUCTION

ECG is a diagnostic tool that is routinely used to assess the electrical and muscular functions of the heart. While it is a relatively simple test to perform, the interpretation of the ECG tracing requires significant amounts of training. The heart is a two stage electrical pump and the heart's electrical activity can be measured by electrodes placed on the skin. The electrocardiogram can measure the rate and rhythm of the heartbeat, as well as provide indirect evidence of blood flow to the heart muscle. Figure shows the electrocardiogram signal from which a standardized system has been developed for the electrode placement for a routine ECG.

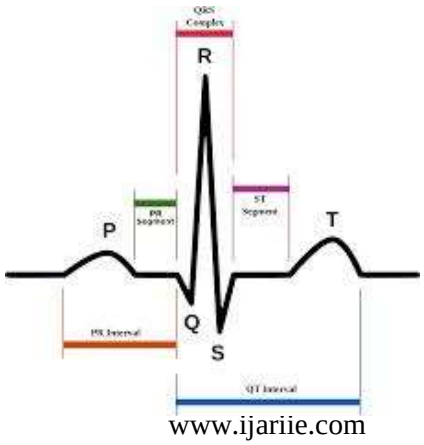

Fig -1 Electrocardiogram Signal

The ECG works mostly by detecting and amplifying the tiny potential changes on the skin that are caused when the electrical signal in the heart muscle is charged and spread during each heartbeat. This is detected as tiny rises and falls in the voltage between two electrodes placed either side of the heart. This work presents a novel easy-to-use system intended for the fast and noninvasive monitoring of ECG signal. A novel heart rate detection algorithm based on the continuous wavelet transform has been implemented, which is specially designed to be robust against the most common sources of noise and interference present when acquiring the ECG in the hands. The heart beat level also detected. The algorithm shows acceptable performance even under non-ordinary high levels of tested in normal use with subjects of different age, gender, and physical condition.

There is wired or wireless technology to transfer the ECG signal out of laboratory and the doctor needs to wait for more time to know the patient ECG and this delay of analyzing ECG will be eliminated in proposed system. The limitations are patient cannot directly monitor their heart rate rhythm from home and must depend on nearby health care center. Also the patient must manually maintain their health historical information. Moreover there is a delay in analyzing the patient ECG.

2. SYSTEM DESIGN

In the proposed system ECG equipment is interfaced with embedded system. It is implemented in a ECG kit containing four electrodes leads, this electrodes are connected to signal conditional unit and the signals are converted to the digital values and then they are passed to the microcontroller. The data collected from the microcontroller will be transmitted with the help of Bluetooth devices and it will be received through the mobiles phones and thus the PQRST wave of different intervals of ECG and heartbeat of values are found.

With the help of this method the ECG can be interpreted in home itself and the data are send to corresponding doctor in the form of video or photo. Figure represents the proposed system model. In this method ECG simulator is connected to the microcontroller and the data from the microcontroller is transmitted to the mobile with the help of Bluetooth. The data transmitted from the Bluetooth is received through the mobile and viewed with the help of android app.

The merits of the system are patient can directly monitor their heart rate rhythm from home itself. The communication link between two devices is fast and the cost of system is reduced. It does not require battery or external electrical connection. Doctors can immediately receive the ECG of the patient.

Fig -2 Block diagram of Proposed System

PIC18F4550 is an 8-bit microcontroller of PIC18 family. PIC18F4550 consists of 32 KB flash memory, 2 KB SRAM and 256 Bytes EEPROM. This is a 40 pin PIC Microcontroller consisting of 5 I/O ports (PORTA, PORTB, PORTC, PORTD and PORTE). PORTB and PORTD have 8 pins to receive/transmit 8-bit I/O data. The remaining ports have different numbers of pins for I/O data communications. PIC18F4550 can work on different internal and external clock sources.

It can work on a various ranges of frequency from 31 KHz to 48 MHz. It has four in-built timers. There are various inbuilt peripherals like ADC, comparators etc. PIC18F4550 is an advanced microcontroller which is equipped with enhanced communication protocols like EUSART, SPI, I2C, USB etc.

The LM358 series consists of two independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

LCD consists of 2x16 with rows and columns to pins that has an in built microcontroller. The LCD standard requires 3 control lines and 8 I/O lines for the data bus. Here, alphanumeric characters are sent in ASCII format.

Information being transferred between data processing equipment and peripherals is in the form of digital data which is transmitted in either a serial or parallel mode. Serial transmission involves the sending of data one bit at a time, over a single communications line.

In contrast, parallel communications require at least as many lines as there are bits in a word being transmitted. Serial transmission is beneficial for long distance communications, whereas parallel is designed for short distances or when very high transmission rates are required.

MAX 232 is placed in between microcontroller and serial ports. It converts 5V data from the controller into 12V the simulator data and transmits through the RS 232.It receives 12V data from devices like PC, GSM etc and converts it into 5V data. Bluetooth is a wireless technology standard for exchanging data over short distances and it is a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization.

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Bluetooth is a standard wire-replacement communications protocol primarily designed for low-power consumption, with a short range based on low-cost transceiver microchips in each device. The data from the ECG simulator is transmitted to the mobile with the help of the Bluetooth.

The app must be able to analyze the ECG signal reading in real-time, and recognize any heart complications that are occurring. The app should be able to analyze this in a short enough time that a “help” message can be dispatched to appropriate parties in cases of emergency and the purpose for the app was to save the cardiogram data of a user.

Android application for interface with ECG kit for monitoring patient health status is created. For this process, first Bluetooth connection with ECG Bluetooth device is established, once the connection is success, to Data from Established connection is received. Then the draw graph using viewed in android.

3. RESULT

To design and build a low cost electrocardiogram device which can be easily used by someone with low technical expertise for around-the-clock ECG self-monitoring and feedback. The project consists of the hardware and software for a wireless electrocardiogram device, and a corresponding Android application which together displays and records the user’s heart signal. ECG equipment with the help of embedded system is implemented. The ECG simulator is connected to signal conditional unit, the analog signals are converted to the digital values and then they are sent to the microcontroller.

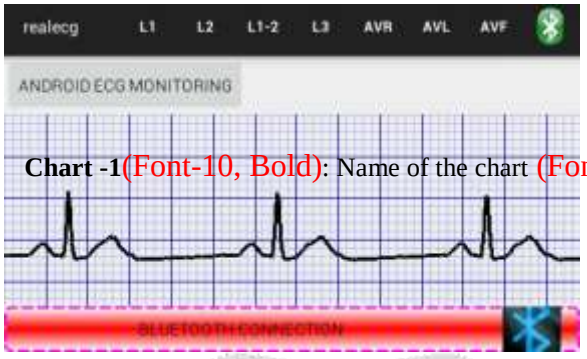

Chart -1(Font-10, Bold): Name of the chart (Font-10)

Waveform of the android - ECG monitoring The data received from microcontroller will be transmitted with the help of Bluetooth device and it will receive through the mobiles phones. The waveform obtained in the mobile through real ECG application is shown in the above figure.

4. CONCLUSION

One of the main and motivating goals of the project is to examine the heart signal in real time and detect any electrical abnormalities. The variation in the heart rate can be determined and depending on the variation the diseases should be detected. The data is currently saved to the app's designated internal storage, only the app itself can read the file. There is currently no functionality for viewing a list of all saved ECG data files in the app, and so these saved files will not be used. As the amount of data saved increases and possibly as the number of devices running this application increase, centralized data storage would be ideal.

5. REFERENCES

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