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Real time ECG signal monitoring using IoT gateway

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Abstract*--Electrocardiogram is a health taping apparatus which is used to track Human heart electrical activity. Each heart beat is triggered by the phases of this electrical activity of excitation (depolarisation) and recovery (polarization). This patient history of the ECG is very important to detect or diagnose heart disease viz., regurgitation of the aortic valve, coronary artery disease, mitral stenosis etc. In our work we proposes to establish an ECG tracking system linked to the Internet of Things and simultaneously store data to the cloud at very inexpensive prices. The medical and paramedic health professionals (Android device) are able to track the patient's heart activity on a continuous basis and can fully remove the assistance near the patient. The medical and med tech medical practitioners (Android device) are capable of controlling the sufferer's cardiac output on an ongoing basis and can remove the aid around the person completely. A three lead sensor module called with electrode leads ADS1292R allows the patient to be positioned above the thorax.*

Keywords*--ECG, Node MCU, IoT*

I INTRODUCTION

The heart serves as a pumping tool that helps distribute adrenaline and food that carries blood throughout the body to keep an active and alive person [1-2]. By sensing the voltage created by the heartbeat, its pumping rate can be easily measured and analyzed for various health checkup [3].A heart rate monitoring device is a handheld device which is used to measure the heart beat and record the values for analysis in future [4]. In earlier models the heart rate monitor consists of a set of electrodes that are connected to the upper front of the body [5]. A safe adult's pumping speed normally is 72 bpm (beats per minute), for children is around 120 bpm and for teenagers the heart rate is 90 beats per minute [6].This heart rate rises from the normal value when the person is doing exercise or doing brisk walk [7]. And it will return to the normal value when we come to normal position [8]. It is an indication of a healthy heart. It the heart rate is higher than normal, it is called as bradycardia and if the value is lower than normal it is known as tachycardia [9-10]. The random procedure of measuring the heart rate

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is to place the thumb over the arterial pulsation and we have to feel the heart rate and for a time period of 30 seconds we have to count the pulse rate and if we multiply this count by 2 we will arrive at the heart rate in bpm [11]. The accurate and ergonomic measurement of heart rate is carried out by an electronic device known as ECG-Electro Cardio Gram, which is very much expensive [12]. For instantaneous measurement there are wrist watch model devices are also available [13].

This kind of devices will give accurate measurement but very expensive [14]. Hence it is proposed to develop a Temperature sensor heart rate monitor is probably a valuable technology to know the body temperature and pulse rate of the subject [15].

II PROPOSED APPROACH

The purpose of this article is to design an apparatus that is capable of monitoring in ambulatory conditions a patient's electrocardiogram (ECG). Out of these signals it is possible to extract multiple data to escape stressful situations or detect Cardiological anatomy. The finished product needs to be compact and lightweight so that it can be easily networked with the consumer. For this reason the connection is simplified to only 3 electrodes. The device communicates with a smart phone over the net. Hence, waveform can be viewed easily.

ECG Devices have been used in medical settings for many years. In many cases, such as during an operation, in intensive care, the emergency room, even an ambulance van, a person's Electrocardiogram may be unstable and needs monitoring. In addition, from these readings, the person's current health status may be determined. This paper proposed an attempt to construct a working version of a ECG device from a relatively cheap set of parts – including a Microcontroller and a WiFi module. A simple microcontroller with enough processing capability can be used to to perform the required tasks for the design proposed. Figure 1 shows the Iot based ECG system.

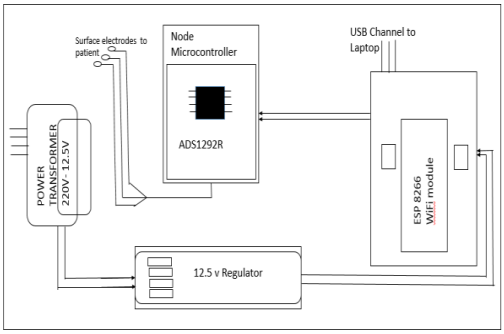

Figure 1: Block diagram of IoT based ECG for monitoring

The ADS129R is a Analog to Digital converter with a programmable gain amplifier, internal reference circuit and an on board oscillator. It incorporates the required features for a low power medical ECG, fitness and sports like portable equipments integrated with a respiration impedance measurement function.The operating temperature range is around –40°C to+85°C.

Node MCU is a lua based Microcontroller which contains a WiFi module using which we communicate the results over the Internet. This module is interfaced with the ADS1292R which is mounted on top of the Arduino UNO board. The pin diagram for the controller is as follows.

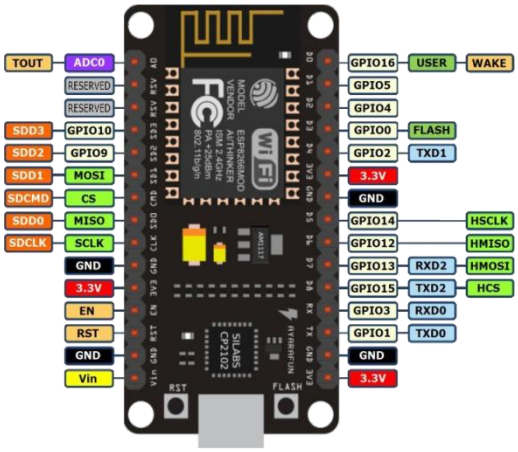

Figure 2: Arduino UNO microcontroller

In Arduino microcontroller board it is based on the ATmega328p architecture. From this board it consist of 14 digital IO pins, 6 pins which is used as a PWM signal generation, analog pins of 6, under the oscillator range of 16MHz, a USB connection and finally with an reset button. All of this comprises everything that to work the MCU which can be connect directly to the adapter or supply or USB cable. Rather, it includes the Atmega8U2, which is designed as a USB to serial converter. The proposed Uno boards is the new tech and it is up to date to the market in an Arduino platform.

POWER SUPPLY. For the supply connection the MCU board can be induced with peripheral socket or through the cable continuity. Appeals from a backup may be loaded into the Battery junction'sVin pin and GND headers. The board supply range is from 6 - 20 volts. The suggested range is between 7 – 12 Volts. The supply Pins are the following:

Vin: When using an outcome terminal for the source of power the Arduino board for input can be utilized using this pin. The other way is it can be processed through this power jack.

5V. The controlled power supply used in the board for controlling the microcontroller and other components. This can either come from VIN via an onboard regulator, or it can be supplied via USB or another controlled 5V supply.

3.3V. An on-board regulator provided supply of 3.3volts. Present total draw is 50 mA.

GND. Earth pins also called as Ground

Traces of the electrocardiogram adapted for diagnosis are collected using surface electromyography (EMG), in which electrodes are surrounds on the upper layer of the hand or chest near the heart. Potential deviations of 1 to 3 mV produced by the current sources in the heart at the body surface are collected by the inner plates and boosted to enhance the signal-to-noise ratio (SNR). The ECG signal is processed on an oscilloscope or Computer

or is computerized for encourage processing by a hardware device (as will be the case for recognition purposes). The process of digitization shall use a examine rate of 1 kHz to indicate that the trace of ECG is of appropriate quality as needed for biometric applications. Various kinds of noise can corrupt ECG measurements. They are due to the following factors.

1. Power lineinterference,
2. Motionartifacts,
3. Electrode contactnoise,
4. EMG noise, and
5. Instrumentation noise

III RESULT &DISCUSSION

Figure 3 illustrate the hardware circuitry of the implemented system.

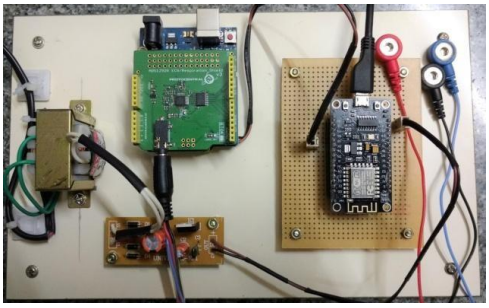

Figure 3: Hardware circuitry of the system

The ECG output is measured using the probes fixed in appropriate positions in the body. The healthy ECG waveform is shown in Figure 4.

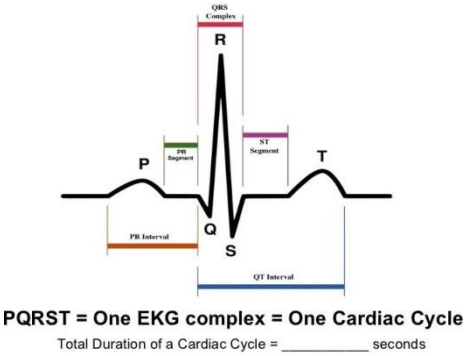

Figure 4: Healthy ECG Waveform

But the actual measured waveform is shown in the mobile phone and in the remote server through Wynk App is shown in Figure.5. The noises alter/deform the waveform and change the DC level of the waveform. Most of the noise is due to stray signals and ripple from the DC power supply.

Figure 5: ECG Output waveform in mobile device

IV FUTUREWORK

The paper has suggested and developed a productive and fruitful IoT enabled ECG monitoring device. The challenging part that was encountered during the process noises distorting ECG waveform. The noises alter/deform the waveform and change the DC level of the waveform. Most of the noise is due to stray signals and ripple from the DC power supply. This is rectified to a large extent using Digital Signal Processing. It is also observed that the 3-probe sensor has its limitations in cancelling previously mentioned noises. It can be improved by using sensors with more probes. The only trade off with using more probes is the overhead cost associated with the final product. A latest version of the simulation software exhibits the near-real ECG waveform and heart rate, but there is nothing to report. There is a lot of margin for advancements to generate alert for the greater the threshold of above or below of heart rate.

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