IMPLEMENTATION OF PROTABLE DEVICE FOR REAL-TIME ECG SIGNAL ACQUISITION ON SOC

P. Chakaravathy[1], M. Anto Bennet[2], R. Lavanya[3], T. Pavithra[3], and V. Nandhini[3]

[1]Assistant Professor, Department of Electronics and Communication Engineering, VELTECH, Chennai-600062, India

[2]Professor, Department of Electronics and Communication Engineering, VELTECH, Chennai-600062, India

[3]UG Student, Department of Electronics and Communication Engineering, VELTECH, Chennai-600062, India

ABSTRACT: Heart attack is one of major cardiac disease. An electrocardiogram (ECG) is widely used to diagnose these diseases. Now a days, ECG monitoring is one of the major technique used in medical science. This is achieved by extracting amplitudes and durations of the parameter of ECG waveform such as P wave, QRS complex, RR interval and PR durations, temperature and heart beat. These parameters are compared with the normal values to determine the type of abnormalities. Under critical conditions, transmission scheme will ensure successful transmission of critical messages to doctors via Global system for mobile (GSM) network.

KEYWORDS: ECG Waveform, Mobile phone, Wireless sensor networks, GSM.

1 INTRODUCTION

Electrocardiography is the process of enrolling the electrical activity of the heart over a period of time. The electrodes placed on a patient's body and sensing the diminutive electrical changes on the skin that grows from the heart muscle depolarizing during each heartbeat. Cardiac monitoring is the continuous monitoring of the heart activity. Mobile phone has powerful computing, espial and better connectivity resources..ECG data is important for medical diagnosis of such health implications and many specific conditions, including a variety of cardiac arrhythmias. Cardiac arrhythmias is the irregular heartbeat (i.e.to slow or too fast). Tachycardia and Bradycardia are the different kind of beat level in heart. It is the fluster in normal activation sequence of the myocardium.

Cardiac monitoring also the continuous monitoring of the heart activity but it is different from hemodynamic monitoring [1]. The delay between the first attack symptom of any cardiac complaint and foretell the medical consults has a many variations depending upon the patient conditions [2]. The SOC modernize for the body sensor network (BSN) designate to make healthcare closer from the hospital to the patients, to appropriate the bio signal monitoring to be developed usually and limiting within the clinical environment [3]. R-R interval data boast using different HRV analyses and "potential of unbalanced complex kinetics" (PUCK)analysis to lineament of cardiac rhythm in normal condition and cardiac arrhythmia [4]. HBC technology commonly apply the narrow band modulation and its obtain the process FSK or on off keying (OOK) which generate a low data rate kbps [5]. The Conventis System seizures ECG data and mobile transmission. It helps to diagnose symptomatic and asymptomatic in cardiac abnormalities of cardiac arrhythmias [6]. The advance technique in wireless sensor/body area networks (WSN/WBAN) have offer in all ECG monitoring service[7]. ECG is obtained from anti aliasing also used for converting network[8]. The SCP-ECG is the large wide spread standards and differentiate the initial values that exchange and storage of ECG signals [9]. The GSM models easily attain the commands for developing any application [10].The digital heart beat monitor and alert system provides a more unique ,effective and efficient means of real time monitoring of a patients health parameter and as ever since witnessed and unprecedented tremendous advancement.

---

2   SYSTEM DESCRIPTION

In Fig1.patients health parameters such as ECG, Heart beat and temperature is monitored. The values from the temperature and ECG sensor are an analog hence ADC is required to convert the values into digital. Heart beat sensor is digital sensors which can be directly converted with microcontroller. UART is interfaced between controller and Bluetooth for serial communication. UART is interfaced between microcontroller and Bluetooth for serial communication. The values are sent to the mobile through Bluetooth .In the mobile we can see ECG waveform with the heartbeat and temperature values. The GSM (Global System for Mobile Communications) Technique is used to transfer the values in the authorized peoples. The values of the entire system are obtained Continuously. Through this   process the patient health is continuously monitored. This is very useful in case of severe health implication such as heart attack.

3   ECG IMAGE ACQUISITION

The Acquisition is the creation of images such as the physical sense of an object The acquired image is taken into processing, image compressing, reposting and impression. From the Fig1. The imaging values are taken from the sensors. These values given to the Microcontroller. The bio signal is taken from the living beings that can monitor and measured continuously. The output image of the system is the p-q-r-s-t waveform. The output waveform is confined as the ECG of a Heart in normal sinus rhythm.
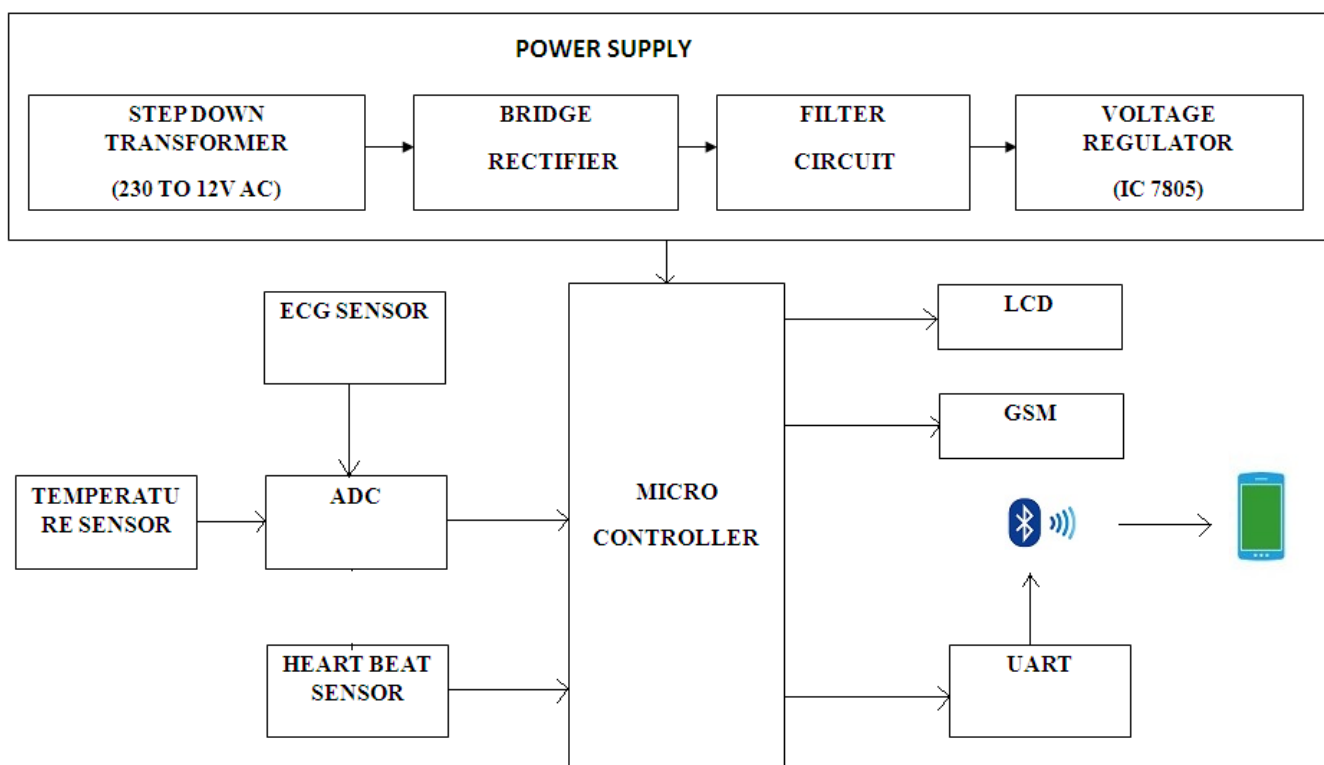

Fig 1.Block Diagram of ECG Acquisition

4   WIRELESS SENSOR UNIT

The optical sensors such as temperature, ECG and Heart beat sensors are used in image acquisition. ECG and Heart beat sensor is designed for the digital output of heart beat when a finger is placed on it. When the ECG and heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to controller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light Modulation by blood flow through finger at each pulse. The pulse value of the patient is measured through this sensor and these analog values are given to the micro controller. Temperature sensors are a device used to measure the temperature of a medium.This senses the temperature of an engine and provides the level of temperature. The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

Fig 2.ECG Sensor with electrodes

5 HUMAN HEALTH MONITORING

Now days, there are many advance treatment in specialized hospital. The ECG image acquirement is one of the advance treatment for heart patients. Basically monitoring is the observation of a patient for some health parameters. The remote patient monitoring is the most advance techniques in the Telemedicine. It is the interface between the telecommunication and information technologies to provide healthcare at a distance. It is mainly used for emergency situation and the critical time of the patients. The ECG image values are taken in the home. The patients no need to suffer for consulting doctor. The main approach of the system is for the older peoples and cardiac patients.

6 SOFTWARE ASPECTS

The software is used to simulate the values of the ECG signal. The ECG waveform (p-q-r-s-t waveform) is simulated in the software and display in LCD screen.

6.1 EMBEDDED C

It is the high level language used in embedded system especially in Digital Processing systems. DSP is the assembly language to define the processor architecture inside out. If the video decoding takes 80 percent of the CPU-cycle budget instead of 90 percent, for instance, there are twice as many cycles available for audio processing. This coupling of performance to end-user features is the characteristic of many of the real-time applications in which DSP processors are applied. DSPs have a highly specialized architecture to achieve the performance requirement for signal processing applications within limits of cost and power consumption set for consumer applications. Unlike a conventional Load-Store (RISC) architecture, DSPs have a data path with memory-access units that directly feed into the arithmetic units.

6.2 MATLAB SOFTWARE

MATLAB is the matrix laboratory and multi-paradigm numerical computing environment in 4G language. The Output of the ECG waveform is simulated in the MATLAB software. It is mainly used for plotting the data and functions. Simulink is developed for programming, modelling, simulating and analyzing multi domain dynamic systems. It is the interfacing of the graphical block diagramming tool and customizable set of block libraries.

6.3 ANDROID APP

An Android app is created for the output of health monitoring system to visualize the smart phone. The authority having the app and monitor the patient continuously for the heart beat and pulse. The GSM communication is used for transferring the information of the patients to the authority. This can also be enhanced with continuous monitoring.

7   GSM COMMUNICATION

Global System for Mobile communication is the second generation networks. The GSM is used to intimate the information about the patients such as pulse rate, heart beat and temperature. Radio frequency (RF) communications allow dispatching the gene of the patient during the trouble of using cables. The range of broadcast the information is wider in the communication. The heart normal beat of

Fig 3.GSM module

the person is between 60 and 90 bpm (beats per minute)in the rest time. If the values changes at the rest time, the patient said to have arrhythmia disease.

8   OUTCOMES

ECG signal is captured in the analog values. These values are sampled and digitized by the digital application. EEPROM is the storage medium of the system and communicate by the GSM and Bluetooth. Our project is prototype equipment having the following features: low cost, easy to implement and versatile. In fact ,the hardware is made with cheap and well known components ;regarding the software, it is also developed in known and widely disseminated environments .The system has many task to be programmed ,which requires a real-time operating system this offers the opportunity of a certain parallelism in treatment .wireless and mobile technologies are key components that would help enable patients suffering from chronic heart diseases to live in their own homes   In Fig4, The P-Q-R-S-T Waveform in the module of the ECG output.

Fig 4.Output for ECG (P-Q-R-S-T waveform)

PR Interval   : 0.12-0.20 sec
QRS Interval : 0.06-0.10 sec
QT Interval   : (QT<0.40 sec)

P wave represents the sequential activation f the right and left atria.

QRS represents the simultaneous activation of the right and left ventricles.

ST segment is a misnomer, T is usually absent. ST-T wave is a smooth continuous waveform.

9   CONCLUSION

The overview of the technology to save the cardiac patients especially from the heart attack. The main approach of the system is used to display ECG signal and intimates the information to the consultants. The system is ameliorate with the sensors and controlled by the microcontroller. The exact values are sensed by the sensor efficiently. Controllers are high speed and has more storage space in this system.

It is the real-time application used in Multi- speciality hospitals. It is more useful in the Intensive Care Unit (ICU). The device is used to avoid the issues in the society.This prototype is mainly used in the severe attack of the patient by continuously monitoring the ECG singal. We are dedicating this to cardiac patients.

REFERENCES

[1] El Mimouni El Hassan and Karim Mohammed, "Design and Implementation of an Embedded   System for Ambulatory Cardiac Monitoring", Journals of Telecommunication and information technology,Jan.2012.
[2] Ufoaroh S.U et al," Heartbeat monitoring and alert system using GSM Technology",International Journal of Engg Research and General Science Volume 3, Issue 4, July-August, 2015.
[3] Liang-Hung Wang et al,"Implementation of a Wireless ECG Acquisition SoC for IEEE 802.15.4 (ZigBee) Applications",IEEE Journal of biomedical and health informatics", VOL. 19, NO. 1, JAN 2015.
[4] Faizal Mahananto and Tomohiko Igasaki,"Cardiac Arrhythmia Detection using Combination of Heart RateVariability Analyses and PUCK Analysis", IEEE EMBS July, 2013.
[5] Jianqing Wang et al,"Wearable ECG Based on Impulse Radio Type Human Body Communication", IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, VOL.NO. 92, Jan 2015
[6] E.Kańtoch et al,"Monitoring activities of daily living based on wearable wireless body sensor network",IEEE Biomedical June 2014.
[7] Chih-Hao Hsu and Sau-Hsuan Wsu," Robust Signal Synthesis of the 12-Lead ECG using 3-Lead Wireless ECG Systems",IEEE Biosignal Oct 2014.
[8] Yu-Cheng Su et al,"Wireless ECG Detection System with Low-Power Analog Front-End Circuit and Bio-Processing ZigBee Firmware" IEEE Journal,Apr.2010.
[9] Jesu´s D. Trigo et al,"Interoperability in Digital Electrocardiography : Harmonization of ISO/IEEE x73-PHD and SCP-ECG, IEEE TRANSACTIONS ON INFORMATION TECHNOLOGY IN BIOMEDICINE, VOL. 14, NO. 6, NOVEMBER 2010.
[10] R. Sukanesh et al, "GSM-based ECG Tele-alert System", International Journal of Computer Science and Application Issue 2010 .