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Recent Trends in Medical Imaging by using VLSI

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ABSTRACT: *Medical Image processing is a hard point to settle any problem with the help of Computer assistant. Doctor is to analyze the medical diagnosis with the help of imaging system. The CT scan, MRI scan, EEG, Ultrasound method can analyze the system of the patient with the help of images. VLSI circuit is used to make single Chips. The Chip is used as a memory element in Computers to store data. Prior to the use of VLSI components for making; the bulk of the effort spent on integration and test in MSI/SSI systems can be applied for design image processing. Now days VLSI ICs have been used widely in medical Imaging such as Ultrasound 3D display, Tumors, by 1st eliminating the recognizable neuro-anatomical structures. VLSI ICs need of medical image processing is to provide fruitful information than exists in the original medical Images etc.*

KEYWORDS: *MSI/SSI systems, VLSI system, EEG, Ultrasound, Medical Images, 3D display, Thermocouples devices, and Complimentary Metal – Oxide Silicon (CMOS).*

I INTRODUCTION

There are so many lifesaving medical apparatus which has been implanted in the human heart, brain and body. One of the medical apparatus is Pacemaker. The main drawback is to linger the charge of the batteries of Pacemaker. Patient require frequent Surgery to have this batteries replaced. The basic work is to create a Low power, Low- voltage circuit for both controlling and switching the charge of battery. And analog ASIC or VLSI circuit is used for controlling and switching the charging current. Lithium ion battery is used to energize the pacemaker. The charge system is portable and bio-free nature. Besides that Ultrasound processing will be enhanced by use of VLSI Technology more than any other medical imaging process, because VLSI is used to impermanent 3D display in Ultrasound system. Now a days Thermocouple devices is used to get heat from body and it converts this heat into the potential difference and this P.D. can be used to charge the battery. By this way to generate enough electricity to power implant Pacemakers. It is to generate a thermoelectric power on the basis of human body. The thin-film of thermoelectric materials is to convert body Temperature (heat) into electrical energy which can be used to charge batteries for Low power devices such as Pacemaker. Complimentary Metal-Oxide silicon (CMOS) uses on Pacemaker and other very sensitive transistor devices in VLSI circuits to result in small like in mm or cm units.

II APPLICATION VLSI CIRCUIT ON PACEMAKER

While very Large Scale integrated (VLSI) circuit uses on to Pacemakers, the functional unit they hold becomes more sensitive to radiation defective. Instead of its Low sensitive analog properties compared to bipolar/unipolar Technology, the uses of CMOS Technology for analog increases its functions. It has some advantages like that CMOS IC Technology is now widely available in the market. Now CMOS ASIC is manufactured than bipolar ICs. Now both mixing analog and digital IC is manufactured by the some well-known concern. The designer is to invent new way how to use CMOS Technology to implement analog functions. Designer is using new Technique, have been very successful in finding new ways to design analog CMOS circuits that can the accuracy of bipolar analog design. VLSI circuits are now widely using in medical imaging instead of General purposes like digital signal processing ICs, custom VLSI ICs, and microprocessors in 3D image displays and Ultrasound -----. It can say that Ultrasound processing will be more effective than any other medical imaging process, because VLSI uses to implement fully digital front - ends to real – time Ultrasound phased array signal processor. VLSI is equivalent to around 100,000,000 transistors. These includes the current generation of microprocessors that have about 40-50 million transistors Current day chip design is at the VLSI level. The next level of VLSI is ULSI(Ultra large Scale Integration) with about one billion transistor which some have coined.

III HUMAN HEART AND PACEMAKER

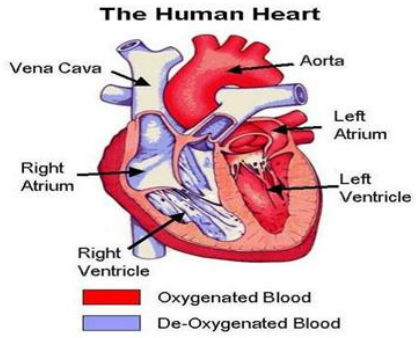

Fig.- 1

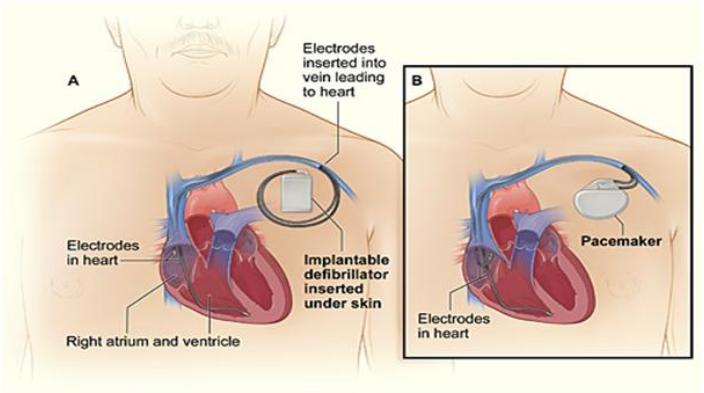

Fig. - 2

The construction of heart of the human is shown above Fig I, with the help of Sinoatrial node (SA) which is situated at the Right atrium of the heart. This Right atrium of the heart contains a buddle of nerves known as the Sinoatrial node (SA). These impulse also tackle along conducting fibers in the atrium to the Atrioventricular node or AV node, situating the depolarization of the node which is located in the Lower part of the heart wall. The SA node called the natural Pacemaker generates electrical impulses, which are mainly responsible for contraction and expansion of heart. A Pacemaker is very small device that is placed under the skin to help control the heartbeat of the human. Patient needs a Pacemaker while (SA) node fails to work. When (SA) node of the heart does not work properly due to heart's rhythm is abnormal. The poor blood supply to heart muscle is called Ischemic heart Disease and this leads to chest pain (Angina pectoris) or myocardial Infarct – Heart Attack. Hypertropy occurs due to enlargement of the heart which may be left Ventricular, left Artrial, Right Ventricular or Right Artrial. The metabolic effects may lead to electrolyte abnormalities, wrong medication or thyroid disease. The batteries life was limited to just three or four years for 5 years warranty Pacemaker. To overcome these limited life of the batteries, we have used VLSI circuit. This problem is also overcome as the body heat converts into electricity and uses this electricity to charge Low power devices. Production of heat in the body can induce electricity with the help of VLSI circuit. This application is not limited to Pacemaker, but it is applicable to other Bio-medical Instruments also.

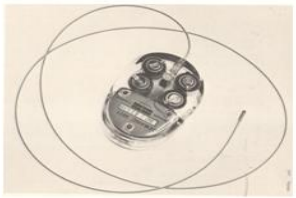

Fig.- 3

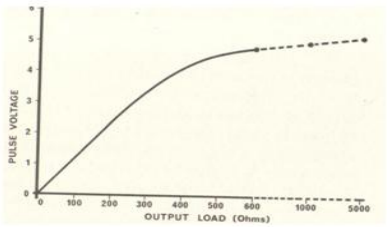

Fig. - 4

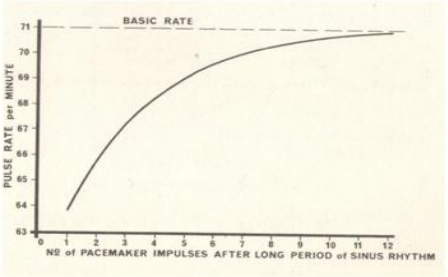

Fig. 5

Fig. 6

Fig. 7

IV MEDICAL IMAGE PROCESSING

The Laparoscopic telescope provides the means of getting an image of the abdominal cavity. Light is sent into the abdominal cavity through the fiber bundle surrounding the rod lens. The diameter of the telescope is used these days are 5 or 10 mm instrument. There are two types telescope uses -- forward viewing and oblique. A, 0°c instrument provides an image which is directly in front of scope and other – oblique viewing scopes have 30°c to 45°c off the centre lines of the instrument . It is used for areas not accessible such as over the dome of the Liver. At the telescope, there is an eye piece which is used as an attachment for the Camera. Medical image processing algorithms could be used for pathological detection, such as tumors etc. Medical imaging processing system diagnoses the disease of the patient. VLSI circuit is used in medical image processing is to provide richer information than that exists in the original medical images. It is considered that the MRI scans of a patient are either colour or gray-scale is displayed with default size. A colour image converted into gray—scale image, than it is required a large matrix whose entries are numerical values Zero and 255; where Zero corresponds to black and 255 to while the brain tumor of the patient can be detected with the help of two stages – namely – image segmentation and edge detection system.

V GENERAL DESCRIPTION OF PACEMAKER

A model of unipolar/Bipolar Pulse Generator (Pacemaker) is shown in the Fig.- 3. It is the demand Ventricular – inhabited type. Programmed from the QRS complex, it delivers its impulses only when patient's Ventricular rate falls below the preset pacing rate of the pulse Generator (Pacemaker). Rate is preset during manufacture at a nominal 72 pulse per minute (PPM), but rates 60 to 72 are available. The longevity of the pulse Generator is extended by the reduction of the pulse duration from 0.9 to 0.5ms – Thus resulting in a decrease in battery current drain. The longevity of pulse Generator's battery may be increased by using VLSI circuit to such pulse Generator. The pacing function of the pulse Generator can be verified during periods of Sinus rhythm by means of a magnet placed over skin of the implanted pulse Generator (Pacemaker). The pacemaker and its components are encapsulated in epoxy and covered with a titanium shield to reduce electromagnetic interference. It contains four number of Lithium ion Cell. The small tip area of the endocardial electrodes of the Devices, and of the epicardial intramurals electrode, results in a high stimulating current density and consequent low threshold. To prevent high current densities, the maximum impulse current will deliver is 10 MA. The output voltage against load impedance is shown in the Fig.- 4. The high current limit is about 20MA. Fig.-5 shows the rate Hysteresis and take-over rate demand Pacemakers will allow the natural rhythm of the patient to drop below the basic rate of the Pacemaker (72PPM) before commencing pace. If the Patient's rate drop below the take-over Rate, pacing commences and the rate builds up to the basic rate over a number of impulses. When patient's rate increases to a value slightly above the basic rate, the Pacemaker will be inhibited and pacing will cease.

VI RESSULT OF PULSE GENERATOR (PACEMAKER)

The Pacemaker performance is shown in the Fig. – 4 and Fig. – 5. The installation (Cross-Section of a chart with pacemaker) of pacemaker is shown in the Fig.- 6 and the placed of Pacemaker is shown in the Fig. – 7.Pacemaker contains 4 Nos. of batteries, Generator, wires with sensors at their tips. The said lead connect to the heart where the pulse rate below normal heartbeat's pacemaker helps monitor and control you're the electrodes detect your heart's electrical activity and send data through the lead to the Computer in the Generator. If heart rhythm is abnormal, the Generator sends electrical pulses to the heart. The Pulses travel through the leads to

reach to heart. There are One or Three leads pulse Generator now a days used, each of the leads are placed in different chambers of the heart.

- One of Pacemaker usually send pulse from Pulse Generator to the right ventricular (Lower chamber of heart);
- Leads of dual chamber Pacemaker carry pulses from Pulse Generator to the right atrium (The upper right chamber of the heart); and
- The leads of a biventricular Pacemaker carry pulses from Pulse Generator to an atrium and both of the ventricles. The pulses help coordinate electrical signaling between the two – ventricles. This type of Pacemaker is called a Cardiac resynchronization therapy (CRT) Device.

I desire to invent more specification of Pulse Generator, but in a short span, it is not possible to work at present. If I get further chance in future, I shall do for the interest of our Patients and also society.

REFFERENCE

[1]. Uyemura, John P. chipdesign for submicron VLSI, P-53, Published Cengage learning;
[2]. Banker, R.J.H.Li W. and Boyce, D.E. CMOS circuit design, Layout and simulation. Piscataway,NJ;IEEE press,1998;
[3]. Chandra, B. and Dutta Majumdar, D. Digital Image processing and analysis, published, PHI,2007;
[4]. Andrews, H.C. and Hunt, B.R. Digital image restoration, prentice- Hall, Englewood cliffs, New Jersey,1977;
[5]. Rao, C. Raju and Guha, S.K. principles of Medical electronics and Biomedical instrumentation, P-32, Published by University Press, 2001;
[6]. Pandey, O. N. Kumar, R. Bio-medical electronics published by Katson, 2007;
[7]. Journal of circuits systems and signal processing published on 30.12.2014;
[8]. Journal IJES, Vol.- 5, January, 2015, PP- 15-19;
[9]. Journal of National heart, lung and blood institute;
[10]. Brown, J.H.U.,J. E. Jacobs, and L. Stark, Biomedical Engineering, published by Philadelphia: F. A. Davis Co.,1971;
[11]. Brazier, M.A. B. ,The electrical Activity of the nervous system. Baltimore, Md. Published by W&W Co. 1968;
[12]. Franklin, D.L. Techniques for measurement of blood flow through Intact Vessels, 'Medical electronics and Biological Engineering,3(1965);
[13]. Kline, J(ed), Biological foundations of Biomedical Engineering, published by Little, Brown and Co.,1976;
[14]. Linzer, M. (ed), Ultrasonic imaging published by New work, Academic Press, 1979;
[15]. Yanof, H. M. Biomedical electronics, 2nd ed. Published by Philadelphia: F. A. Davies Co.,1972;
[16]. Welkowitz, W. and S. Deutsch. Biomedical Instruments, Theory and Design. Published by New Work, Academic Press, 1976.

Bibliography

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