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Comparative Study of Pacemaker Energy Harvesting Techniques.

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ABSTRACT

The rhythmic physiological activity is achieved by SA node in heart. The injection of electrical signal into the heart tissue location to restore the cardiac natural pacemaking system is generally termed as pacemakers. Pacemakers assist patients suffering from cardiac problem with irregular ECG. Even after enormous developments have happened in scientifically & technologically designing a pacemaker system without any disadvantage is still an unsolvable questionnaire. This review article focuses on energy harvesting from human knee joint movement to drive a wireless pacemaker.

Keywords: Pacemaker, Energy harvesting, Magnetic Induction, ECG & Wireless.

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INTRODUCTION

Energy harvesting system generally utilises environmental or human sources of energy. Solar energy and infrared radiations are generally used and under wireless technologies Ultrasound rays, Inductive and capacitive based methods are utilized [3, 4]. Under human energy harvesting mechanical movement of the body parts are given as the input kinetic energy to magnetic, electrostatic and piezoelectric type device to get electrical energy output. In few cases body temperature is converted in to electrical energy by using proper thermo electric transducers [1-3].

Pacemakers are implanted just under the skin of the chest by doing a small surgery. Out of many disadvantages the major issues is replacement of battery after a life time of 5 years as minimum. To increase the lifespan of battery many wireless technology has been available [5]. The normal electrical conductivity of the heart allows electrical propagation to be transmitted from the SA node through both atria and forward to the AV node [6, 7]. Further propagation allows from the Atrio ventricular node to the ventricle and respective bundle branches and fascicles. During normal heart function pumping action is achieved by pacemaker region of the heart [8, 9]. By diffusion of Ca, Na and K ions across the cell membrane electrical impulses are produced. An ECG is used to measure the regular heartbeat, as well as other functions of the heart [11]. If natural pacemaking ceases to function the rhythm of heat functions is disturbed [10, 12].

METHODOLOGIES

Using a hinge knee brace movement of knee is transferred to the input shaft motion. A gear system is used to transfer low acceleration in to into high acceleration which drives the generator system with permanent magnet stator dynamometer action. The overall system was divided into two sections as transmitting section and receiving section. The role of transmission section is to convert kinetic energy in to electrical energy and through magnetic coupling the energy is feed into to receiving section without electrical contact. Generated electrical signals are converted in to high frequency signal using an oscillator circuit. The high frequency signals are transmitted to remote receiver my transformer Faradays law of mutual induction principle. The circuit composed of transmitting section with charging section is as shown in figure 1.

Figure 1: Transmission section with charging system

In the receiving section coil with N_2 number of turns are provided to achieve the transformer action by acting as secondary part. Based on number of turns in the receiving coil voltage can be increased or decreased. Received electrical signal by transformer action is converted in to DC signal. By using suitable voltage multiplier circuit required DC voltage can be obtained.

RESULTS AND DISCUSSION

From transmitter circuit energy will be transmitted to receiver circuit through mutual inductance. Microcontroller checks battery level and if battery level is above 90 percentages then the relay switch will be in off position and LCD screen will be displayed with battery full message. When relay switch is in off position now power is transmitted between transmitter and receiver [7- 9, 13]. The system utilizes simple movement of

knee alone and output voltage is sufficient to drive a pacemaker. Energy harvesting from human knee can be suit for using in powering pacemakers.

SUMMARY AND CONCLUSION

The portable energy harvesting system using human knee movement as the primary source method was compared with the conventional method. Any harvesting system can extend three to five years then usual life period of pacemaker even any harvesting methods are employed. Even after enormous developments have happened in scientifically & technologically designing a pacemaker system without any disadvantage is still an unsolvable questionnaire.

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