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Energy Generation Through Footsteps Using Piezo Electric Sensors

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ABSTRACT:

Theproduction of electric power from the footstep movement of the peoples and the pressure exerted during walking is the main objective of this project. The mechanical power transformation into electrical power as the pressure exerted by the footstep and by using transducers. One of the most interesting methods of obtaining the energy surrounding a system is to use piezoelectric materials.In this project we are designing a model using piezo electric sensors, which changes mechanical energy developed by the individuals on the floor to electrical energy. This conversion is done from mechanical force that is human weight.Man has needed and used energy at an increasing rate for the sustenance and well- being since time immemorial. Due to this a lot of energy resources have been exhausted and wasted. Proposal for the utilization of waste energy of foot power with human locomotion is very much relevant and important for highly populated countries like India where the railway station, temples etc…

Keyword: Piezoelectric sensors,LCD, analog to digital conversion,renewableresourses,footstep power generation system.

1.INTRODUCTION

Walking is a common activity in human life. When a person walks, he loses energy to the road surface in the form of vibration, sound etc., due to the transfer of his weight onto the road surface, through footfalls on the ground during every step. This energy can be converted to the usable form such as in electrical form.When person applies dynamic pressure on this platform their body weight compresses the setup of system and current produced is stored in a battery. More movement of people will generate more energy. It can also be noted that the setup harness human locomotion power by making use of the mechanism that would derive energy from pounding feet in crowded places. This method generates the electricity without polluting environment. The source of energy is continuous and renewable.An alternate method to generate electricity there are a number of methods by which electricity can be produced, out if such methods footstep energy generation can be an effective method to generate electricity.

2.PROBLEM STATEMENT

Nowadays energy and power are the one of the basic necessities regarding this modern world. As the demand of energy is increasing day by day, so the ultimate solution to deal with these sorts of problems is just to implement the renewable sources of energy. But these renewable energy sources must have to be adopted in practical manner by keeping an eye on all aspects regarding the research work. Proposal for the utilization of waste energy of foot power with human locomotion is very much relevant and important for highly populated countries like India where the villages, temples etc., are overcrowded all round the clock. Electricity is one of the daily requirements of life. It is required to increase as much as sources of renewable energy. This system can be used for utilization of waste energy of foot step to provide electricity during the cut-off of electricity in some places like gym or any crowded places. For example, there is cut-off of electricity because of that gym members are not able to measure their weight on weighting scale and in the night, visibility is disappear due to cut-off of electricity. This system can be used with different techniques like use with weighting scale etc.

3.LITERATURE SURVEY

Hajra Ahmad, Komal Naseer, Mahjabeen Asif, Muhammad Farhan Alam "Smart Street Light System Powered by FootSteps". Year: 2019. Volume: 1. Pages: 122-124. The enormous amount of Electrical power is being used by street lights, which remain switched ON throughout the night. This causes a huge wastage of electrical power across the whole world and it should be minimized. The main purpose of implementing automatic street lights is that light will switch ON with full intensity only when there are vehicles or pedestrians on the road and remain off otherwise. The street lights can be powered by the electrical energy generated through the pressure applied by footsteps and vehicles. So we don"t need to provide power to the street

lights separately. The automatic street light system comprises of DC lights, lux meter, PIR sensors, Piezoelectric sensor, LDR and Ultrasonic sensor. Here the main purpose is to make such a street light system in which intensity of street lights increases when a car comes closer to it and decreases when it moves away from the light pole.

Dr. A. Senthil kumar ,Dr.R.Nafenna, Feroz Basha , KarunyaJensi "Smart Management of Street Light for Energy Conservation". IJERT, Year: 2020. This paper proposed smart light for energy conservation using Arduino with Wireless module. We use two parts in this paper it includes IR sensors and zigbee transceiver. In city side the street lights are always working at night even though no vehicle moving in the road, so lot of electricity are consumed. To reduce much more consumption of electricity we proposed zigbee and sensor technology. IR sensor controls the switch on/off light when it detects any person entered into road.

Sijun Du, Ashwin A Seshia "A fully integrated split-electrode sychronised-swithharvestingon-capacitors(SE-SSHC)rectifier for piezoelectric energy harvesting". IEEE International SolidState Circuits Conference-(ISSCC), Yesr:2018. In order to efficiently extract power from piezoelectric vibration energy harvesters, various active rectifiers have been proposed in the past decade, which include Synchronized Switch Harvesting on Inductor (SSHI), Synchronous Electric Charge Extraction (SECE), etc. Although reported active rectifiers show good performance improvements compared to fullbridge rectifiers (FBR), large off-chip inductors are typically required and the system volume is inevitably increased as a result, counter to the requirement for system miniaturization. In this paper, a fully-integrated split-electrode SSHC (synchronized switch harvesting on capacitors) rectifier is proposed, which achieves significant performance enhancement without employing any off-chip components. The proposed circuit is designed and fabricated in a 0.18 μm CMOS process and it is co-integrated with a custom MEMS (microelectromechanical systems) piezoelectric transducer with its electrode layer equally split into four regions. The measured results show that the proposed rectifier can provide up to 8.2× and 5.2× boost, using on-chip and off-chip diodes respectively, in harvested power compared to a FBR under low excitation levels and the peak rectified output power achieves 186 μW.

According to N.-C. Park, B.-H. Ko, Y.-P. Park, and Y. Ahn, Vibration and acoustic noise arise from the Multilayer Ceramic Capacitor (MLCC) because of the piezoelectric effect of dielectric substance which consists of BaTiO3BaTiO3. However, the phenomenon is not analyzed clearly because the MLCC shows different behavior compare with ordinary piezoelectric substance like PZT. Thus, MLCC was tested under the several DC biases conditions and heat treatment effect was also tested and analyzed in this paper. From the test, MLCC shows not only piezoelectric effect but also another physical phenomenon like electrostriction. Also, it was verified that DC bias affect to the piezoelectric constant of MLCC.

C. Keawboonchuay paper is based on investigation presents and discusses maximization techniques for a high-power piezoelectric pulse generator. Maximizing the piezoelectric generator's output power is done by maximizing the product of generated voltage and output current. The maximization methods are derived from the mechanical and electrical models of the generator and provide design guidelines as to the geometric dimensions of the piezoelectric material and circuital conditions that will produce maximum power in the device.

International journal of scientific and engineering research by Anil Kumar Due to the rapid depletion of the main fossil source of energy (oil), it is vital to search for other sources of energy. Also, the global pollution due to traditional sources of energy moves scientists to search for other sources of green energy. One sustainable and green source of energy is the power generation from the human footsteps. This research work aims to design and test a simple device that converts the kinetic energy of the human footsteps to electrical energy. This device may be used in all crowded spots with a big number of pedestrians such as mosques, churches, etc.

S. D. Mendhule, and V. K. Kankal states that the slab of concrete harnesses kinetic energy whenever it is stepped on. This energy, created by 5 millimeters of flex in the material, is then either stored by lithium polymer batteries contained within the slabs or transmitted immediately to streetlights or other electronics located close by. The current model, made from stainless steel, recycled car tires and recycled aluminum, also includes a lamp embedded in the pavement that lights up every time a step is converted into energy (using only 5 percent of the generated energy).

According to Kim, H., et al High-intensity focused ultrasound (HIFU) has been used successfully in clinics for the treatment of a variety of cancerous and benign tumors. Characterization of the focused acoustic field is of importance in the planning of ablation procedure and further development of HIFU technology. Quantitative estimation of acoustic intensity is feasible using the infrared thermography on an absorber. However, the current approach is limited to low power output. In this study, a theoretical model was established to describe the acoustic field and absorbed energy in the absorber with the presence of harmonics in the HIFU pressure waveform at the focus and then to calculate the temperature elevations during the HIFU heating, from which the acoustic intensities could be derived.

4.BLOCK DIAGRAM

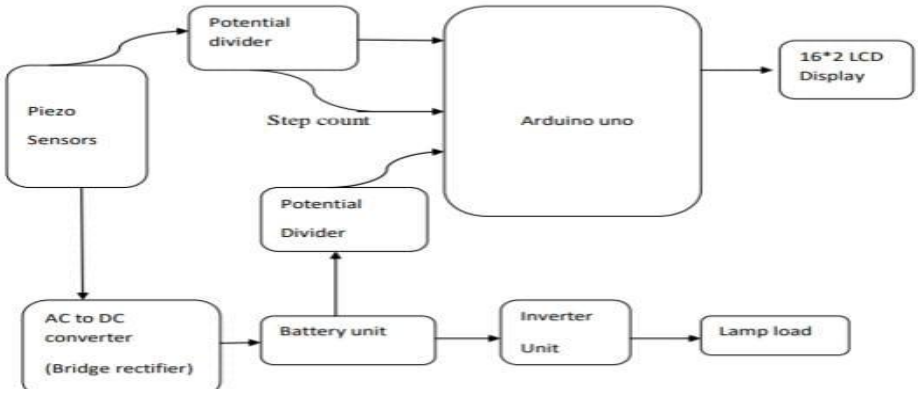

FIG 4.1 BLOCK DIAGRAM

5.METHODOLOGY

The footstep power generation technique through piezoelectric sensors producers electrical force by changing mechanical energy of the development of individuals on the floor to electrical energy. Creation of power utilizing piezoelectric sensors kept along the footpaths which can be ready to supply the force at whatever time of our prerequisite.The energy harvesting circuit block consists of 8 piezo transducers placed on a wooden Planck. When a dynamic pressure is applied on them, voltage across the piezo transducer is generated. The output of piezoelectric sensor is not stable so we use bridge rectifier to convert the variable voltage into a linear voltage. Approximately 8-12V from this piezo transducer bank is produced.The voltage generated by the piezoelectric transducer bank gets stored in capacitor which also maintain the constant voltage and when all the stored energy is transferred to battery. The battery used here is a lead acid battery, 12V. Voltage divider configuration which lowers the voltage to the level of microcontroller as we can‟t fed 12V directly to the capacitor so it is used to divide the voltage. Diode blocks the current flowing from capacitor to piezoelectric sensor. In indicator section includes LED to indicate the power generation. Inverter converts 12V DC to 220V AC, by this AC voltage AC loads can be operated. After reading the battery voltage and the voltage generated from the piezo electric transducer is displayed on 16*2 LCD.

6.SYSEM REQUIREMENTS

The system requirements consists of hardware and software implementation of the project.The hardware components used areArduino uno,Piezosensor,LCDdisplay,Lamploa d,Batteryunit,Power Inverter ,Bridge Rectifier ,Potential divider ,Connecting wires.Then come to software requirements we are using Arduino ide which is open source software**..** Approximately 8-12V from this piezo transducer bank is produced. One end of the bridge rectifier is given to capacitor of 100uF. The voltage generated by the piezoelectric transducer bank gets stored in capacitor and when the switch is slided all the stored energy is transferred to battery. The battery used here is a lead acid battery, 12V. Potentia divider configuration which lowers the voltage to the level of microcontroller as we cant fed 12V directly to the capacitor so it is used to divide the voltage. Diode blocks the current flowing from capacitor to piezoelectric sensor. In indicator section includes LED to indicate the power generation. Inverter converts 12V DC to 220V AC, by this AC voltage AC loads can be operated. After reading the battery voltage and the voltage generated from the piezo electric transducer is displayed on 16*2 LCD. The LCD is interfaced with the microcontroller AT MEGA328P for programming purpose. This microcontroller is of 8-bit, 32kb flash with 1K RAM and has 16MHZ speed.

7. ADVANTAGES

- Reliable, Economical, Eco-Friendly .
- Less consumption of Non-renewable energy.
- Externally wide dynamicrange, almost free of noise, suitable for shock measurement as well as foralmost imperceptible vibration.

8. DISADVANTAGES

- Only applicable for particular places .
- Initial cost is high.
- Output affected by temperature variation.

9. APPLICATIONS

- Home applications
- Street lightening
- Emergency power failure situation

10.CONCLUSION

The project “ENERGY PRODUCTION THROUGH FOOT STEPS USING PIEZO ELECTRIC SENSORS“ which gives the best economical, affordable energy solution to common people. This can be used for many applications in rural areas where power availability is less or totally absence using this project, we can drive both AC and DC loads according to the force we applied to the piezoelectric sensor. The increase in the use of alternative resources for renewable energy can substantially decrease carbon footprint and consequently the effects of global warming. So, we are implementing this system to generate energy by using piezo electric sensors, the design of proposed system is to provide electricity to run clinics/hospitals. The necessity to minimize the wastage of resource and the ever- increasing demand for the electricity is the major concern in our project. We connect piezo plates to DC-DC Booster and it is further connected to super capacitors, battery and inverter. Switch controls the AC load

which finally serves our goal of providing electricity to rural clinics/hospitals. This whole report gives idea about the components used to design the system, working principle, advantages.

11.FUTURE SCOPE

Footstep arrangement is used to generate the electric power. As the power demand is increasing, this arrangement is used to generate the electrical power in order to meet the large energy demand. In this arrangement the mechanical energy is converted into electrical energy.

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