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FOOT STEP POWER GENERATION

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ABSTRACT

We use to walk by foot by generating power which goes waste around us and which transform electricity during movement by our footsteps. The energy can be stored by using piezo electric materials. As in material science the properties of material in all shape helps to produce various things like the metal and nonmetal ferrous metals, means metal which contains iron is called ferrous material and material which not contains ferrous material is call nonmetal ferrous metals. Piezo electric is one of the important materials of material science.

In this method piezoelectric components are used and due to deformation of dissimilar material directly the electric charge effect is created. Once the electric energy is generated it can be stored by using various means for the further use. Here in our project the non-conventional method is used to generate electric power just by moving or you can say simply walking number of times on the arrangement made as the input source. Here piezo electric sensors are used which send signal and transform electric energy once you are moving on the arrangement made. The voltage which can be stored can be utilized to charge mobile phones. At present crises are already there in world to generate electric energy free of cost as at present the energy is generated by fossil fuels, solar energy, wind mills by using waves flowing at a high speed and strikes on wind blade and generate electricity by making arrangement to store electricity.

1. INTRODUCTION

In this system the voltage is generated by the footstep force created while movement. Here by using non-conventional sources that is force and its stored and used. This system of generating electricity can be installed at various places where more movement of peoples are there every day for their own work like hospitals,

railways stations, airports, offices, vegetable centers. At all these places the system can be installed where more people's movement at entry and exit is found. Once the person put there steps on system where sensors are installed and the voltage on every step is generated when mounted in series and good amount of electricity is generated. The piezo electric sensors are used for this purpose and the effect of force, pressure, acceleration gives signals. The voltmeter is attached to measure the output and just by using small led lights it can be demonstrated.

2. METHODOLOGY: MODEL OF FOOT STEP GENERATION

Fig. 1. Storing Device for Foot Step Electric Energy

How the foot step converter work is shown in figure. In picture right side shows without applying load and in left side picture weight of the body is transferred on the top plate. The bulbs of 12 V and 6 V are connected to the output of the alternator which glows to show the electric output once foot load is applied. The output from the generator was fed to a 12 lead acid battery with the help of an ac-dc converter bridge. At the start, the battery was completely discharged. Then, by applying foot load, the energy generated was stored in the battery. A 100 W, 230V bulb was connected to the battery through an inverter. The duration for which the bulb was on, the number of footsteps and corresponding energy stored per step is shown in Table 1.

Table 1: Energy storing table

No. of footsteps	Duration of lighting a 100 watt 230 Volt bulb (s)	Total energy (J)	Energy/step (J)
250	6	600	2.4
500	12	1200	2.4
750	18	1800	2.4
1000	25	2500	2.5

3. PRINCIPLE

The basic principle on which the project is based is the piezoelectric sensor. The wooden plates that are above and below the sensors and moveable springs are adjusted suitably. Here, non-conventional source of energy generated using foot step is converted into mechanical energy which is then changed into electrical energy. The foot step board consists of 16 piezo electric sensors which are in parallel connection. On the application of pressure to the sensors, the sensors will convert mechanical form of energy into electrical energy. The electrical energy generated will be stored in the 12v rechargeable battery that has been connected to inverter. For giving supply to the circuitry, conventional battery charging unit is used. This inverter is used to convert the 12 Volt D.C to the

230 Volt A.C which is used to activate the loads. This AC voltage can be used to operate AC loads.

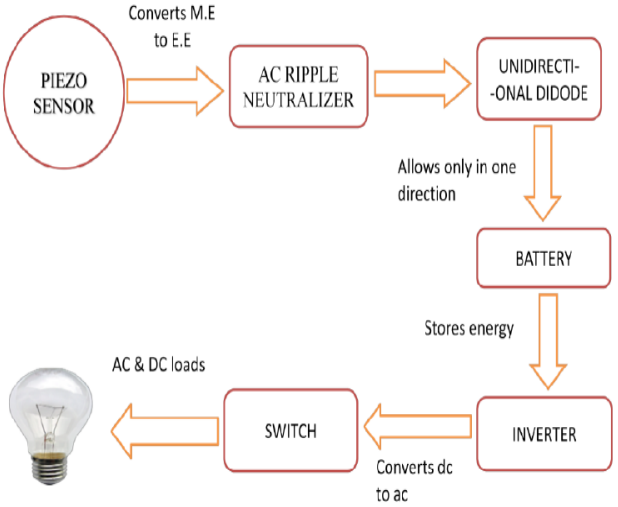

Fig 2: Block diagram

Two possible types of connections were tested - parallel and series connections. There was not much considerable increase in the voltage output in the parallel series connection. Additional piezo film results in the series connection helped in increasing the voltage output but not in line are proportion. In this project, the combination of both parallel and series connection were deployed for producing 40V voltage output that has a high current density. An inverter was connected to battery to provide provision to connect AC load. The voltage that has been generated across the tile can be observed in the LCD.

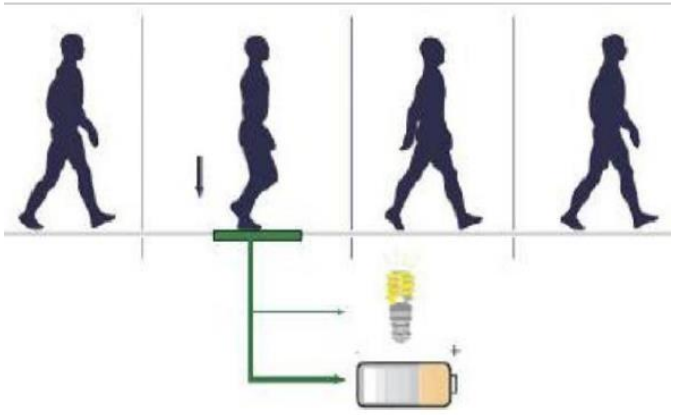

Fig 3: Schematic representation of working model

4. CALCULATIONS

A charge is generated across the piezo material on the application of force. Thus, the piezo material can be assumed to be equivalent to an ideal capacitor. Thus, all capacitors equations can be applied to it. 3 piezo in series are connected to one tile. After making 10 such series connections they all are connected to each other in parallel. Thus when 3 piezoelectric discs are connected in series, The equivalent capacitance when all the connections are done is:

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

We know,

$$Q = C * V$$

So,

$$C = \frac{Q}{V}$$

Hence,

$$\frac{Veq}{Q} = \frac{V1}{Q} + \frac{V2}{Q} + \frac{V3}{Q}$$

Thus,

$$Veq = V1 + V2 + V3$$

Hence, from the equation above, the net voltage generated in series connection is equal to the sum of individual voltages obtained across each piezoelectric disc. 13V is the output obtained from 1 piezo disc.

$$V_{eq}=V1+V2+V3$$

$$= 13+13+13$$

$$=39V$$

Thus, the maximum voltage is 39V that can be produced across the piezo tile in this setup.

People with weights ranging from 40kg to 75 kg were made to walk on the piezo tile to test the Piezo tile's voltage generating capacity. The relation obtained between the weight of the person and power generated is plotted in figure 8. It can be inferred that maximum voltage is obtained on application of maximum weight/force.

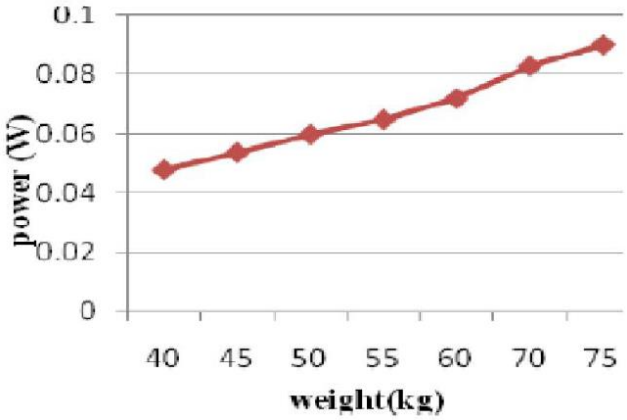

Fig 4: Power vs weight graph of Piezo tile

5. ADVANTAGES AND DISADVANTAGES

Advantages: -

- By simply walking on step, power is generated.
- Fuel input is not required.
- It has long service life due to lack of moving parts
- No external power is required as it is self generating.
- Reliable, Economical, Eco-Friendly.
- Battery is used to store the generated power

Disadvantages:

- It can be used only in the particular place.
- The temperature variation affects the output.
- Care should be taken for handling batteries

6. APPLICATION OF SYSTEM

- The foot step generate power can be used for street-lighting, agricultural, home applications.
- The generated energy can be used in

emergency power failure situations

- Metros, Rural Applications etc.
- It can be used as a source for both A.C and D.C applications

7. CONCLUSION

It is an economical, affordable energy solution for energy generation. It finds many applications in rural areas where power availability is quite low or totally absent. Comparison between various piezo electric material resulted in showing that PZT is quite superior in characteristics. Also, the comparison resulted in showing that series - parallel combination connection is more efficient. A linear relation has been found between the weight applied on the tile and corresponding voltage generated. It is suited for implementation in crowded areas. It can be used in street lighting without requiring the use of long power lines. It also finds application in charging ports, lighting of pavement side buildings. Our primary energy consists of only 11% of renewable energy. The deployment of this project can help in reducing the energy crises problem and also contributes to in creation of a healthy global environmental change.

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