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HARNESSING PIEZOELECTRIC ENERGY IN SHOE-EMBEDDED SENSORS FOR CHARGING MOBILE

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Abstract: An element generating electric energy by vibration when an impact is applied, as can be described a piezoelectric sensors device. Presently, these piezoelectric sensors devices are used to power station equipment and LED lamps on bridges, where they are installed at the floor around ticket gates and bridge decks. However, one disadvantage of these piezoelectric sensors devices is that the generated electricity is too low because of little present current. Experimentally, the developed power generating shoes have been evaluated for their validity under various types of piezoelectric sensors devices, shoes and secondary batteries. Currently, it is found out that only up to 1.5% mobile phones can be charged which is indeed very low. So, we take piezoelectric sensors and after placing them in the soles of shoes, we run or walk. The energy produced by the sensors passes through bridge rectifier and gets converted to DC. The DC is stored in rechargeable battery which in turn charges the phone. To increase energy production, shoe designs should be improved and charge/discharge circuits created for them. Every day we all walk around going from one place to another. When we walk, we move forward by pushing the ground backward with our feet. Our project aims at utilizing this energy to generate electricity thus providing us with an opportunity to utilize wasted energy in earlier days hence bringing forth a 'smart shoe' as a step towards a modernized future.

Keywords: Piezoelectric sensors, rechargeable battery, smart shoes, energy saving, phone charging

I. INTRODUCTION

Piezoelectric materials possess the unique property of converting mechanical strain into electrical charge and vice versa. By strategically placing these sensors in the right leg of a shoe, we can capture the mechanical energy exerted during each step and store it in a renewable battery.

The smart shoe would work through a group of piezoelectric sensors connected in series and parallel on the sole of the smart shoe, which are further used to charge a lithium ion battery. This battery forms the power Centre of the smart shoe and gives power supply to various circuits.

The stored energy can then be utilized to charge mobile devices, such as smartphones, providing a sustainable and convenient power source.

As the technology has been developing, the use of power generating wearable devices has been increased. But their battery life is stilla bothering thing. Currently, energy generation by Human movement is the most convenient way to power these devices. Many devices including backpack, clothes, insoles are been used to convert human generated mechanical energy to electrical energy. Among all these, shoes are indispensable daily necessity. People generate a huge amount of energy when they walk and collecting energy from the shoes is very simple and effective. Hence the idea of generating power with shoes emerged. By walking energy can be generated and converted into electric energy to charge electronic devices. Energy Generation by shoes can be done by two methodswhich are Piezoelectric and Electromagnetic.

II. LITERATURE SURVEY

In this paper, a power generating-shoe with a piezoelectric sensors device-based power generator built into an insole is proposed for the purpose of utilization in disaster-affected areas. First, the mean generated energy per step was verified by experiments using three types of shoes. It has been confirmed that a large difference occurs in the generated energy due to the structure of shoes. Next, the experiments were carried out by changing various dimensions of the piezoelectric sensors device. In these experiments, the mean energy per step increases accordingly, parallel to the device size. Moreover, the comparative verification of three types of secondary batteries has been investigated for the charging of the mobile phone. In these verifications, the secondary battery suited for practical use has been evaluated, and the electric

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energy and the theoretical value were quantitatively compared. As for future works, improvement of the generated energy with the optimization of structure design, reducing the differences in energy across various type of shoes and verification of the durability of the power generator is expected. In addition, it is necessary to develop a power-management circuit that can perform charging with little loss from a piezoelectric sensors to a secondary battery [1].

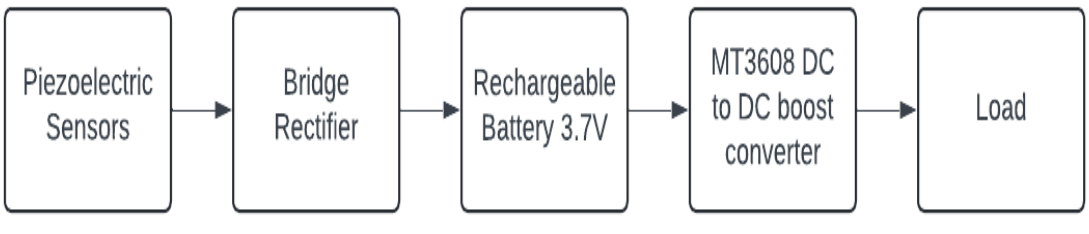
From this project, we conclude that by using natural renewable resources, power can be generated. There is no need of fuel. This electrical energy is supplied for various purposes such as charging of laptops and mobile phones. It can be laid in pavements, roads, football ground and also infrastructure projects. The efficiency of this technology depends on the number of people passing over that pavement and axle load from the vehicles moving on them whereas in football ground the pressure given by the players while running on them or hitting the ball on the ground. For developing countries with more population, energy management is a big challenge. It can also be used in rural areas where power availability is less or totally absent. More research is underway to increase efficiency, optimality and durability of the device under varying conditions and for the suitability of the technology for the mass development and commercialization of the equipment [2].

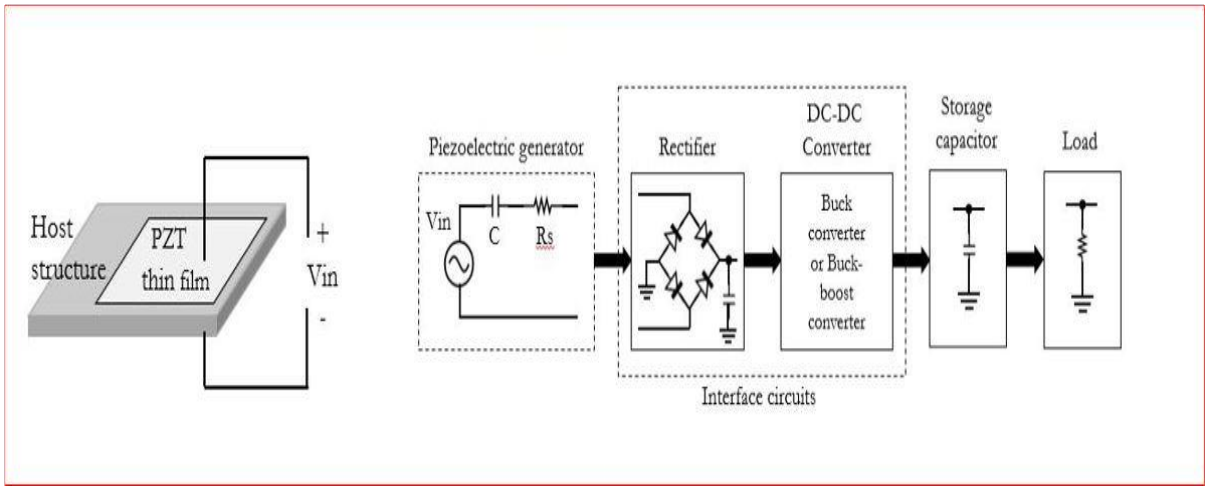
The design of the proposed energy conservation system for mobile phones and laptop keyboards has been presented in this paper. The design presented here will be quite effective in providing an alternate means of power supply for the mentioned devices during emergency Further, the approach presented in this paper can be extended to many other applications where there is scope for similar kind of energy conservation [3].

In this paper, we have analyzed an alternative renewable energy resource. In today's challenging times, where the problem of energy generation is rising, electricity generating shoes are the effective way of generating power. At places of less or no power, these shoes are useful to all and also the cost is comparatively low. The assembly is easy and maintainable. It is the best solution of the problem regarding power. Further, walking for some time is going to burn calories and make the individual healthy if done regularly as well as produce electricity and use for household purpose[4].

III. METHODOLOGY

BLOCK DIAGRAM





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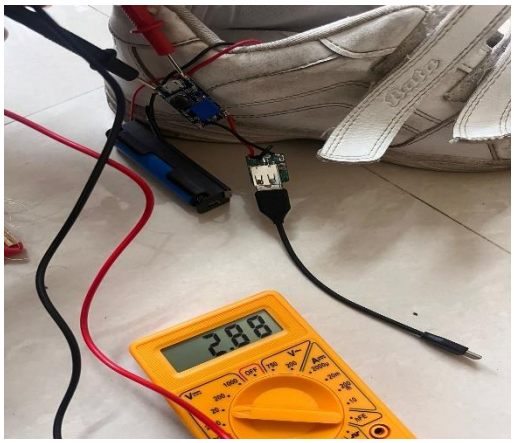
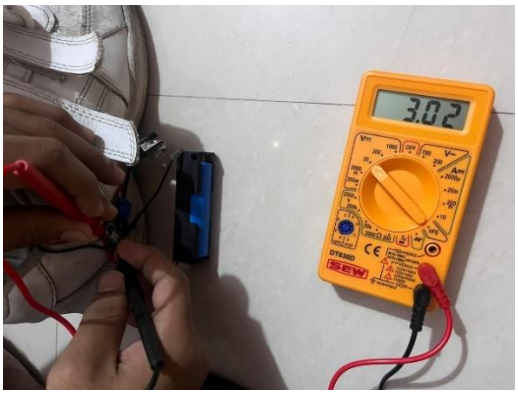
WORKING

Three piezoelectric sensors at the heel and two at the front of the shoe are connected in series to each other via wires. On applying kinetic energy on them, it is converted into electrical energy. Piezoelectric sensor produces AC.A bridge rectifier is connected to convert AC created from sensor to DC. The DC is then stored in the rechargeable battery of 3.7V. This charge is then give to the charging module through the MT3608 converter.MT3608 is a DC to DC boost converter which is used to amplify the input voltage. Through the charging module, a phone can be charged using a USB cable. When the battery gets discharged, it can again be charged using the piezoelectric sensor.

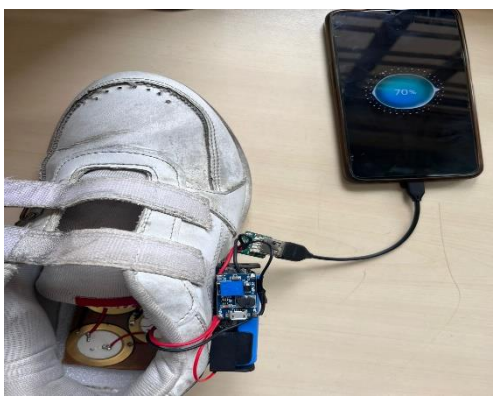
IV. RESULT



Battery voltage before charging battery using piezoelectric sensors



Battery voltage after charging battery using piezoelectric sensors



Final output of our project

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Actions	Voltmeter readings	Distance
Walking by Foot	18.53 volts	5Km
Running by Foot	9.6 volts	2km

V. APPLICATIONS

1. **Mobile Device Charging**: Smart shoes convert the mechanical energy from walking into electrical energy. This energy can be used to charge mobile phones, smart watches etc.
2. **Emergency uses:** In remote or disaster-affected areas, smart shoes could power emergency uses. They transmit distress signals, aiding search and rescue operations.
3. **Smart Insoles**: Smart shoes connected with shoe insoles could provide real-time feedback on foot pressure distribution, helping prevent injuries.
4. **Navigation Systems**: Shoes with sensors could power navigation systems, guiding users through rough terrain or indoor spaces.

VI. CONCLUSION

In conclusion, we have found solutions in our project for the problems which were complicated circuit that were not durable and did not store the energy. Usage of a simplified circuit gives better chances at identifying errors and rectifying them. Since energy produced from piezoelectric sensors is abrupt and unpredictable, usage of rechargeable battery helps in sustaining the power for later use. Proper cushioning of circuit inside the sole of shoe helps in keeping it intact and safe.

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