Power Generating Shoes Charge Your Phone Anywhere, Anytime

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***Abstract*—This aim of this paper is to generate power from shoes and how do we use piezoelectric crystals in order to successfully generate enough electricity in order to power a mobile phone in cases of emergencies like when trekking etc. Piezoelectric materials are materials that convert mechanical energy to electrical energy which can then be used for various purposes. Shoes are a good choice for installing piezoelectric materials because we have to walk a lot in our day to day life and the energy from walking is wasted so using this we can utilize this energy and use it whenever needed.**

***Index Terms*—piezoelectric, electricity, shoes, battery, environment friendly.**

1.INTRODUCTION

As our world is evolving and progressing at a evermore fast rate, our dependance on electronic devices like mobiles, watches, etc has increased drastically. But some people like trekkers, high altitude climbers can't make use of the tech for their benefit like to navigate their way through the jungle etc because of the battery's of the phones running out and hence they becoming useless after the battery dies as there is no reliable source of energy in areas of trekking and high altitudes. So they just cannot use the technology for their benefit even if it is needed so much at that time. Hence we think these shoes can be useful to everyone but especially trekkers and high altitude climbers as it can help save their live's as they can navigate their way out of the jungles, mountains with a help of a mobile phone through a compass, google maps, etc.

2.EASE OF USE

A. CHARGE ON THE GO

The shoes will be made in such a way that they will be able to charge a power bank by generating electricity through walking. The power bank can then be used to power any electronic device that we need. The shoes will not be uncomfortable to wear and will be converting otherwise waste energy generated by walking to useful high grade electric energy. This means it will be environment friendly.

3.STRUCTURE AND POWER GENERATED

In this section we will be explaining the power generated by the shoes and their structure.

3.1 Structure of the Shoes:

The shoes are designed to generate electricity through piezoelectric effects. To generate a specific and high amount of electricity, we will need to maximise the pressure on the piezoelectric plate but at the same time the shoe should also be safe to not hurt the wearer in case of bending/breaking of the plates. The design will be as such that we will be designing a small cylinder that will go under the sole of the shoe on the heel above the piezoelectric so that while walking, the pressure will be strong and will be acting at points along the circumference of the cylinder wall. Hence we can maximise the pressure on the plate and thus produce maximum electricity. Power-generating footwear, sometimes referred to as energy-harvesting footwear or kinetic energy footwear, is a category of wearable technology created to harness the motion of walking or running to produce electrical power.

Sole Structure: -

Outer Sole:

The main energy-harvesting components are normally located on the outer sole of shoes that generate power. Since it is in direct contact with the ground, this layer is subjected to each step's pressure and impact.

Midsole:

Under the shoe's exterior sole, there is frequently a

cushioned midsole that gives the wearer support and comfort. Energy-harvesting elements are incorporate into this layer in some shoe designs that generate power.

Inner Sole:
The portion of the shoe that makes touch with the wearer's foot is the inner sole. It often doesn't have any energy-harvesting components and is only intended to provide comfort and foot support.

Mechanism for Harvesting Energy:
Piezoelectric Materials: The main energy-harvesting component of many power-generating shoes is piezoelectric material. Piezoelectric materials produce electrical voltage in response to mechanical pressure or stress. Usually in the form of thin layers or patches, these materials are frequently included into the sole structure.

Wiring and electronics:
Electronics for power management: Some energy-producing footwear may include electronics for power management, such as rectifiers and voltage regulators, to condition the generated electricity for the best use or storage.

Energy Reserves:
Batteries or Supercapacitors: Built-in batteries or supercapacitors can be used to store the electrical energy created by the shoe. These energy storage systems keep the collected energy in reserve for subsequent use or to directly power electrical equipment.

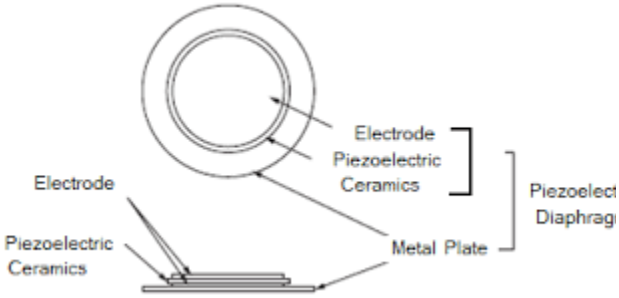
Ports of Output:
Our shoes come equipped with built-in powerbanks so that they car be charged and the energy can be stored in them for long amounts of time and can be used in the future to charge all other types of electronic devices. Energy by the energy-harvesting device is collected and transferred to the powerbank using conductive wires.

Considerations for Design:
Durability: The mechanical stress and wear that come with walking and running must be able to be withstood by our power-generating shoes. The energy-harvesting elements must be durable and strong.
Comfort: For us, comfort is also a key component of wearable technology. Wearer comfort is a top priority in the design of our shoes to promote frequent use.
Aesthetics: To promote adoption, the design of our shoes is pleasing and does not differ noticeably from other types of footwear.

4]Working principle:
These shoes incorporate piezoelectric materials, typically in the form of crystals such as lead zirconate titanate (PZT) or specialized polymers. These crystals have a unique property wherein they generate an electrical charge when subjected to mechanical stress or pressure. When a person wearing these shoes takes a step, the sole of the shoe experiences mechanical deformation as it presses against the ground. This deformation results in the compression and expansion of the piezoelectric crystals within the shoe's sole.
As the crystals deform, the internal structure of the material is perturbed. This disturbance at the atomic level leads to the separation of positive and negative charges within the crystal lattice, creating an electrical potential difference, or voltage, across the crystal. This process is highly efficient, converting a significant portion of the mechanical energy into electrical energy. The electrical energy generated by the piezoelectric crystals is then captured and directed towards a storage system. Most power-generating shoes are equipped with a built-in energy storage unit, often a rechargeable battery or a capacitor. This component stores the harvested electrical energy for later use.
The stored energy can be utilized to power various electronic devices integrated into the shoe, such as LED lights for visibility, fitness trackers, or even small sensors. Some advanced models may include wireless charging capabilities, allowing the energy to be wirelessly transferred to external devices like smartphones or other wearables.
Power-generating shoes offer a sustainable and eco-friendly solution for generating electrical energy during everyday activities like walking or running. They promote energy-conscious living by harnessing the energy that would otherwise go to waste, reducing the reliance on traditional power sources and contributing to a greener future.

5]PIEZOELECTRIC:

1)Effect:
When mechanical stress, such as compression, tension, or bending, is applied to a piezoelectric material, the internal structure of the material becomes distorted. This distortion causes the charge centers within the material to separate, resulting in the generation of an electric voltage across the material. This voltage can be collected and used as an electric signal.
2)Structure of Piezoelectric Plates:



6]Components Used:
1)Piezoelectric Crystals:
We are using multiple piezoelectric crystals under the high pressure points of the feet. We have used multiple piezoelectric crystals under the heel part of the foot because the pressure is maximum over the heel part of the feet and hence maximum pressure will be generated under the heel part and hence maximum electrical energy will be produced.

Fig Piezoelectric Crystal

2)Piezoelectric Transducers:
These devices are electric devices used to convert one form of energy into another form of energy like in this case it is used to convert electrical energy to chemical energy for storage in the battery.

3)Capacitor:
A capacitor is a simple electronic device used to store electrical energy. It is the backbone of modern electronics and it also helps in creating a potential difference across its plates and hence it works just like a small battery.

Fig Capacitor

4)Lithium Ion Battery:
A lithium Ion battery is used to store large amounts of electrical energy and is hence used in almost all modern day electronics like laptops , mobile phones, etc. It stores electrical energy with the help of lithium ions and hence it is appropriately named Lithium Ion Battery. In the battery, the lithium ions move from the negative electrode to the positive electrode during discharge and vice versa when charging .

6.CONCLUSION

In conclusion we can say that generating electrical energy from renewable sources of energy is the future of our planet and is essential in survival of the human race. This type of process where we can generate electricity just by simply walking can prove to be a huge boon for our society as well as for us at a personal level . It can help reduce monthly expenses and also help reduce our dependency on the coal power plants to meet for our demands of electricity. This electricity can be useful in many cases like charging of laptops, charging of mobile phones etc which are electronic devices we cannot live without nowadays. It is mainly useful in rural areas where the electricity supply is less because of their remote location. This technology can help us in providing electricity to those areas and help in their development and also in education of the children living there. Further study is being done to determine whether the technology is suitable for the mass production and commercialization of the equipment as well as to improve the device's efficiency, optimal performance, and durability under a variety of scenarios.

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