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Energy Harvesting from Human Motion for Sustainable Wearable Electronics

Gauri S. Morkhade[1] , Krutika M. Sharma[2], Fareed Dawood Kachhi[3], Bilal4
[1,2,3,4]*Student, Electronics and Communication, Govt. polytechnic Khamgaon, Maharashtra, India*

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ABSTRACT

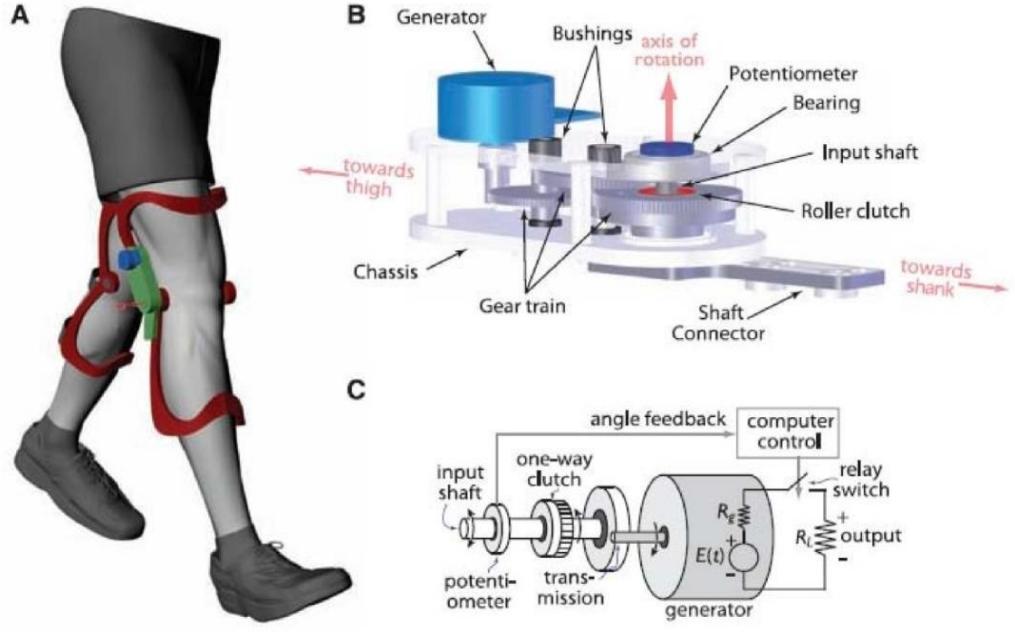
This paper presents a study on energy harvesting from human motion for sustainable wearable electronics. The rapid growth of wearable electronics such as smartwatches. The rapid growth of wearable electronics such as smart watches has increased demand for sustainable power source. Conventional batteries require frequent charging; renewal leading to maintenance issues and effect the environment. Energy harvesting from human motion provides a renewable solution by
converting mechanical energy generated from daily activities such as walking into electrical energy using piezoelectric mechanism. This discusses study on piezoelectric, electromagnetic, and triboelectric energy harvesting technique. Experimental observations shows that piezoelectric sensors embedded in footwear can generate 2V to 8V depending on walking speed and applied pressure. This generated energy is stored in supercapacitor. This system is compact, low cost suitable for low power wearable devices
Keywords:- Energy harvesting, Wearable electronics, Piezoelectric sensors, Sustainable power, Human motion

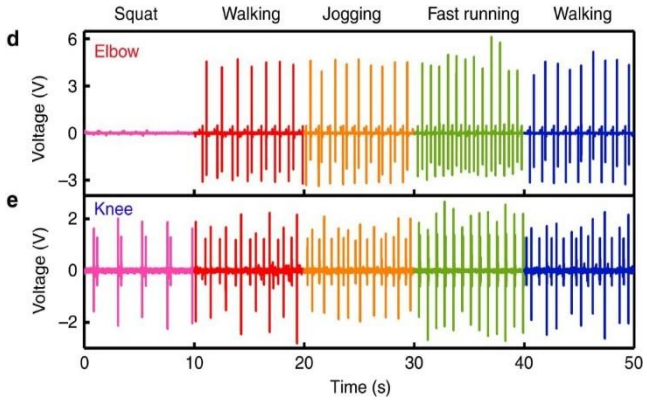
1. INTRODUCTION

Wearable electronics are widely used in healthcare, sports tracking, and smart textile this increasing demand has created need for alternative power sources. Most device relay on rechargeable batteries which requires frequent charging and battery disposal creates environmental concerns. Human motion is a continuous source of mechanical energy this energy can be converted into electrical energy using suitable transducer.

2.WORKING PRINCIPLE

The proposed system consists of piezoelectric sensors embedded inside shoes or wearable bands. Due to the mechanical stress produced by human movement piezoelectric material generates an electrical voltage. When a body moves the piezoelectric sensor undergo physical deformation or friction creating a flow of electron that generate an alternating current (AC). This AC voltage is rectified using a bridge rectifier (converts AC to DC) and stored in capacitor. A voltage regulator ensures stable DC outputs for powering low power devices.





3.APPLICATION

Energy harvesting from human motion has a wide application in health care, smart textile, sports and consumer electronic. Health care monitoring system, ECG patches, Heart rate monitor, Blood oxygen sensor, Smart health bands

Fitness and Sports wearable
Athlete and Fitness enthusiasts use wearables to track: Steps, Calories burned, Running speed, Body movement

Smart Textiles and E-Textiles
Energy harvesting elements can be integrated into: Smart jackets, Shoes, Gloves, Military uniforms

Military and Defense Applications
Soldiers carry heavy battery packs for communication and tracking systems. Motion-based energy harvesting can: Reduce battery weight, Extend mission duration, Power GPS and communication modules

Implantable and Biomedical Devices
Low-power implantable devices such as : Pacemakers, Insulin pumps, Neural stimulators

Advantages
Renewable and eco-friendly, Reduces battery replacement, Sustainable for small devices

Limitations
Low output power, Efficiency depends on motion, Initial design complexity

4. CONCLUSION

Energy harvesting from human motion provides a sustainable solution for powering low power electronic devices. It has strong potential for wearable and IoT applications.

5. ACKNOWLEDGEMENT

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6. REFRENCES

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