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Power Generation from Footsteps by Using Piezoelectric Sensor

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Abstract:- Day by day the use of electricity has been increasing, hence it is necessary to generate electricity using a nonconventional system for conserving natural resources. Here we propose an advanced power generation system using footsteps. The system consists of piezoelectric sensors, Arduino UNO, LCD Display, PIC microcontroller, voltage boosters, battery, LDR and a socket for mobile charging. When the footstep pressure is applied on the piezoelectric sensor, it generates voltage, which in further generates electrical power. The sensors are placed in such an arrangement so as to generate maximum output of voltage. This is then provided to our monitoring circuit. By using this system, maximum voltage obtained is 22 Volt per step and minimum 1 Volt per step. By observing the footsteps at railway station, the power generated by piezoelectric sensor in 24 hours is approx. 78.4Volts.

I. INTRODUCTION

The population growth is causing a significant rise in energy wastage across various sectors. To address this, piezoelectric sensors are being utilized as a promising solution. These sensors convert pressure into voltage, harnessing energy from mechanical forces. Footstep power generation is one such energy-saving approach, generating voltage through human motion. The proposed project aims to leverage this concept by generating voltage through footstep force, particularly in public spaces like bus stands, railway stations, and shopping malls. These systems are strategically placed where foot traffic is abundant, generating voltage with each step. This innovative approach not only taps into renewable energy sources but also contributes to the conservation of natural resources, offering a sustainable solution to energy generation and reducing reliance on conventional power sources.

➢ *Aim*

The aim of the project is to generate electricity by non-conventional means and to store that energy for further usage.

➢ *Objectives*

- Generating power out of free energy.
- To reduce the expenditure on power generation.
- The Goal is to promote the use of various Economical methods for power generation.
- The Goal is to develop a cleaner and more cost effective method of power generation.
- To convert mechanical energy into electrical which is used in energy harvesting devices.

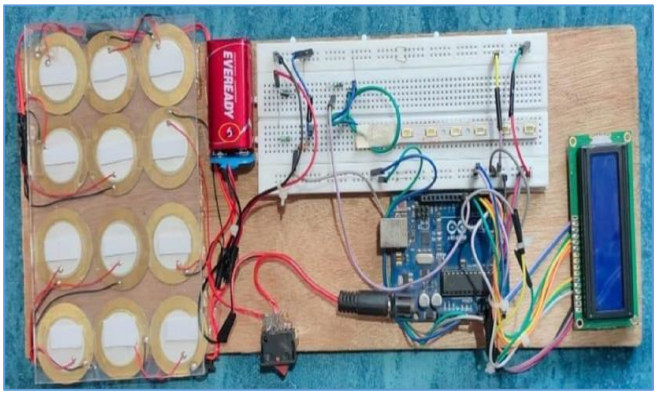

Fig 1 Actual Model of the Project

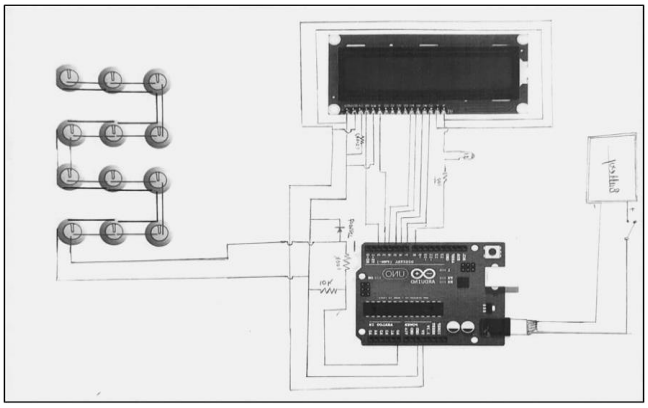
Fig 2 Circuit Diagram

II. METHODOLOGY

The project involves piezoelectric sensors, Arduino Uno, LCD screen, PIC microcontroller, voltage boosters, regulators, and a battery. Piezoelectric sensors detect pressure changes, converted into voltage by boosters. Correct wiring is crucial. A microcontroller manages the system, filtering AC components from the sensor output. Steps include sensing, voltage generation, boosting, filtering, control, and display. It efficiently converts mechanical energy into usable electrical power. Proper setup ensures optimal performance.

➢ *Step 01. Setup and Connection*

- Connect the piezoelectric sensor to the Arduino board. B] Ensure proper wiring and polarity connections.

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➢ *Step 02. Circuit Design and Programming*

- Design a circuit using a breadboard to connect the piezoelectric sensor to the Arduino.
- Write a program in the Arduino to read analog voltage from the sensor.
- Program logic to trigger an LED or small device when pressure is detected.

➢ *Step 03. Testing and Calibration*

- Calibrate the sensor to ensure accurate pressure measurement.
- Test the system by applying pressure to the sensor and observing LED activation.

III. OBSERVATION

➢ *Considering Daily Footsteps at a Railway Station*

Table 1 Considering Daily Footsteps at a Railway Station

Sr. No	Daily Hours	Number of Steps	Voltage Generated
(1)	Steps in peak hour (9 a.m. to 7 p.m.)	30,000	(30000/700) = 42.8 V
(2)	Normal hour	15,000	21.4 V
	(Morning 6 a.m. to 9 a.m.)	10,000	14.2 V
	(Night 7 p.m. to 12 p.m.)		

- Hence, total voltage generated by observing footsteps at a railway station in 24 hours is 78.4 Volt approx.

IV. CALCULATIONS

Different weights of pressures are applied on the piezoelectric sensors to get different voltages. The voltage further gives electrical power. When high weight of pressure is applied, it gives more voltage and vice versa. The power generation in a piezoelectric array varies depending on the specific steps used.

- Based on practical results, voltages obtained are-
- Maximum Voltage= 22Volt per step
- Minimum Voltage= 1Volt per step
- If considering average weight of a person stepping on the system to be 55 Kg the average calculation is-
- Steps required to increase 1Volt charge in battery = 700
- To increase 12Volt in battery, total steps required will be= [12x700] = 8400 Steps.

V. RESULTS

In results, we have found that more is the pressure applied, greater will be the voltage and power generation. The system is completely useful in public places. By using this energy conservation system and piezo sensors, we are proposing a new method for power generation.

- From the observation we get,
- Maximum voltage = 22Volt per step
- Minimum voltage = 1Volt per step

VI. CONCLUSION

Piezoelectric sensors offer a sustainable solution for footstep power generation, efficiently converting mechanical energy into electricity. Their adaptability across different environments makes them suitable for widespread implementation in public spaces. Further research and development are needed to unlock further advancements and realize the full potential of this innovative technology in a greener future.

REFERENCES

[1]. M. Nitashree, et.al; 'Footstep Power Generation Using Piezoelectric Material' International Journal of Advanced Research in Electronics and Communication Engineering, Vol. 4, pp. 2503-2506, Oct 2015.
[2]. D. Marshiana, et.al; 'Footstep Power Production using Piezoelectric Sensors' Research Journal of Pharmacy and Technology, Vol. 9, pp. 831-834, Jul 2016.
[3]. V. Panneerselvam, et.al; 'Portable DC Regulated Power Supply from Footsteps'; International Journal for Scientific Research and Development, Vol.5, pp. 916-918, April 2016.
[4]. R. M. Mahidur and R. Sarker, 'Vibration based piezoelectric Energy Harvesting Utilising Bridgeless Rectifier Circuit' Journal Kejuruteraan, pp. 87-94.
[5]. P. Madhu, et.al; 'Electrical Power Generation using Footsteps using Piezoelectric Transducers' International Journal of Recent Trends in Engineering and Research [IJRTER] Vol.2 pp. 108-115, June 2016.
[6]. D. Vatansever, et.al; 'Alternative Resources for Renewable Energy Piezoelectric and Photovoltaic Smart Structures, Global Warming,' – Impacts and Future Perspectives, 2012,pp. 264-268.
[7]. Majeed, 'Piezoelectric Energy Harvesting for Powering Micro Electrical System (MEMS),' Journal of Undergraduate Research, vol 5, pp 1-5.