



e-ISSN: 2319-8753 | p-ISSN: 2320-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 6, June 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.512

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Footstep Power Generation Using Piezo Sensors

P Usha Rani¹

Assistant Professor, Department of Electronics and Communication Engineering, Mahatma Gandhi Institute of Technology, Telangana, India

ABSTRACT: Here we propose an advanced footstep power generator system that uses piezo sensors to generate power from human footsteps. The system allows for a platform for placing footsteps. The piezo sensors are mounted below the platform to generate voltage from footsteps. The sensors are placed in such an arrangement so as to generate maximum output voltage. This is then provided to our monitoring circuitry. The circuit is a microcontroller based monitoring circuit that allows user to monitor the voltage and charges a connected battery by it. It also displays the charge generated and displays on an LCD display. Also it consists of a USB mobile phone charging point where user may connect cables to charge mobile phone from the battery charge. Thus we charge a battery using power from user footsteps, display it on LCD using microcontroller circuit and allow for mobile charging through the setup.

KEYWORDS: Piezo sensors, monitoring circuit

I. INTRODUCTION

There are a number of methods by which electricity can be produced, out of such methods footstep energy generation can be an effective method to generate electricity. Walking is a common activity in human life. When a person walks, he loses energy to the road surface in the form of vibration, sound etc, due to the transfer of his weight onto the road surface, through footfalls on the ground during every step. This energy can be converted to the usable form such as in electrical form. The energy wastage can be converted to usable form using the piezoelectric sensor. This sensor converts the pressure on it to a voltage. So by using this energy saving method that is footstep power generation system we are generating power.

Human-powered transport has been in existence since time immemorial in the form of walking, running and swimming. However modern technology has led to machines to enhance the use of human-power in more efficient manner. In this context, pedal power is an excellent source of energy and has been in use since the nineteenth century making use of the most powerful muscles in the body. Ninety-five percent of the exertion put into pedal power is converted into energy.

Paper is organized as follows. Section II describes footstep energy generation can be an effective method to generate electricity Section III. Section presents the methodology IV presents experimental results showing results of images tested. Finally, Section V presents conclusion.

II. RELATED WORK

In this diagram, piezoelectric is connected with battery and battery voltage is measured by voltage sensor the sensor is connected to Arduino Uno in this diagram. The charging point is connected to the battery terminal. And the value is displayed in LCD 16*2. The piezoelectric sensor is connected to a series connection output efficiency is high comparing to parallel connection. The voltage sensor is using to measure the generating power form piezoelectric output power should be stored on the battery. Charging is connected with the battery terminal in between the battery to charging we have connected the 5V regulator circuit for chargingpoint.

Working of a PiezoelectricSensor

The commonly measured physical quantities by a piezoelectric sensor are Acceleration and Pressure. Both pressure and acceleration sensors work on the same principle of piezoelectricity but the main difference between them is the way force is applied to their sensinglement.



In the pressure sensor, a thin membrane is placed on a massive base to transfer the applied force to the **piezoelectric element**. Upon application of pressure on this thin membrane the piezoelectric material gets loaded and starts generating electrical voltages. The produced voltage is proportional to the amount of pressure applied.

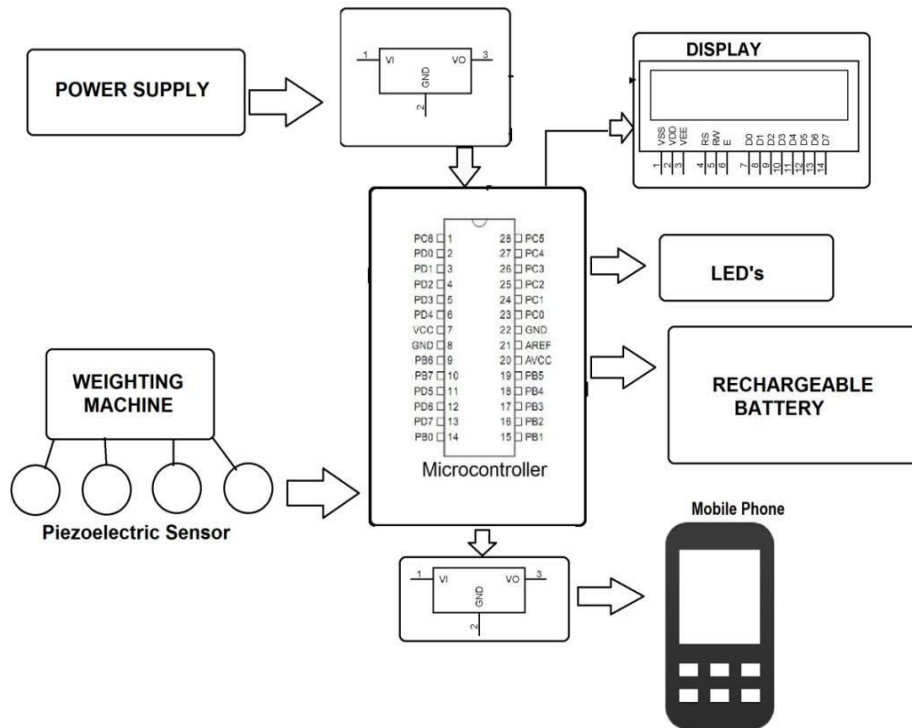
In **accelerometers**, seismic mass is attached to the crystal element to transfer the applied force to piezoelectric materials. When motion is applied, seismic mass loads the piezoelectric material according to **Newton's second law** of motion. The piezoelectric material generates charge used for calibration of motion.

An acceleration compensation element is used along with a **pressure sensor** as these sensors can pick up unwanted vibrations and show false readings.

III. METHODOLOGY

The Footstep power generator works on the principle of piezoelectric effect. Piezoelectric Effect is the ability of certain materials to generate an electric charge in response to applied mechanical stress. Thus, squeeze certain crystals (such as quartz) and you can make electricity flow through them. In most crystals (such as metals), the unit cell (the basic repeating unit) is symmetrical; in piezoelectric crystals, it isn't. Normally, piezoelectric crystals are electrically neutral: the atoms inside them may not be symmetrically arranged, but their electrical charges are perfectly balanced: a positive charge in one place cancels out a negative charge nearby. However, if you squeeze or stretch a piezoelectric crystal, you deform the structure, pushing some of the atoms closer together or further apart, upsetting the balance of positive and negative, and causing net electrical charges to appear. This effect carries through the whole structure so net positive and negative charges appear on opposite, outer faces of the crystal.

Normally, the charges in a piezoelectric crystal are exactly balanced, even if they're not symmetrically arranged. If you squeeze the crystal (massively exaggerated in this picture!), you force the charges out of balance. Now the effects of the charges (their dipole moments) no longer cancel one another out and net positive and negative charges appear on opposite crystal faces. By squeezing the crystal, you've produced a voltage across its opposite faces and that's piezoelectricity. In our project we have used the same phenomenon of producing piezoelectricity from piezoelectric crystal in the form of coin shaped disc. When one steps on the weighing machine the piezoelectric disc gets compressed. After the leg is lifted the crystal is decompressed. Thus a full vibration is sensed by the crystal disc and a voltage across it is produced. This voltage is sensed by the voltmeter and displayed on its display. Also, at the same time this voltage is used to charge the 12VDC Battery. LED's have been mounted under the weighing machine that is switched on by relay through 555 timer IC whenever a voltage is generated. This event is notified by a glowing LED on the PCB. (Also one can hear the switching sound of the relay) Thus, whenever a person walks through the weighing machine the battery gets charged due to the voltage which is also displayed on the voltmeter. This event is notified by glowing LED's beneath the weighing machine.



IV. EXPERIMENTAL RESULTS

HARDWARE TESTING:

Continuity Testing: In electronics, a continuity test is the checking of an electric circuit to see if current flows (that it is in fact a complete circuit). A continuity test is performed by placing a small voltage (wired in series with an LED or noise-producing component such as a piezoelectric speaker) across the chosen path. If electron flow is inhibited by broken conductors, damaged components, or excessive resistance, the circuit is "open". Devices that can be used to perform continuity tests include multi meters which measure current and specialized continuity testers which are cheaper, more basic devices, generally with a simple light bulb that lights up when current flows.

An important application is the continuity test of a bundle of wires so as to find the two ends belonging to a particular one of these wires; there will be a negligible resistance between the "right" ends, and only between the "right" ends. This test is performed just after the hardware soldering and configuration has been completed. This test aims at finding any electrical open paths in the circuit after the soldering. Many a times, the electrical continuity in the circuit is lost due to improper soldering, wrong and rough handling of the PCB, improper usage of the soldering iron, component failures and presence of bugs in the circuit diagram. We use a multi meter to perform this test. We keep the multi meter in buzzer mode and connect the ground terminal of the multi meter to the ground. We connect both the terminals across the path that needs to be checked. If there is continuation then you will hear the beepsound.

Power on Test: This test is performed to check whether the voltage at different terminals is according to the requirement or not. We take a multi meter and put it in voltage mode. Remember that this test is performed without microcontroller. Firstly, we check the output of the transformer, whether we get the required 12 v AC voltage. Then we apply this voltage to the power supply circuit. Note that we do this test without microcontroller because if there is any excessive voltage, this may lead to damaging the controller. We check for the input to the voltage regulator i.e., are we getting an input of 12v and an output of 5v. This 5v output is given to the microcontrollers' 40th pin. Hence we check for the voltage level at 40th pin. Similarly, we check for the other terminals for the required voltage. In this way we can assure that the voltage at all the terminals is as per the requirement.



V. CONCLUSION

The project "Foot step power generation" is successfully tested and implemented which is the best economical, affordable energy solution to common people. This can be used for many applications in rural areas where power availability is less or totally absence. As India is a developing country where energy management is a big challenge for huge population, by using this project we can drive both AC as well as DC loads according to the force we applied on the piezo electric sensor. Our prototype demonstrates that a floor generator can be done.

ADC generator can illustrate the concept, but the reliability and durability are questionable, newer technologies could make a very reliable generator. Proposal for the utilization of waste energy of foot power with human locomotion is very much relevant and important for highly populated countries like India and China. The whole human/ bio-energy being wasted if can be made possible for utilization, it will be great invention and crowd energy farms will be very useful energy sources in crowded countries. Some 28,527 steps, for example, could power an entire moving train for a second. the crowd farm could also be used to harness the head-bashing energy at a rock concert. Non-conventional energy system is very essential at this time to our nation.

REFERENCES

- [1] BinoyBoban, Tom Jose V, SijvoMT, "Electricity generation from footsteps; A Generative energyResources"International journal of Scientific and research Publication 1-3, March 2013.
- [2] Rich Meier, Nicholas Kelly, OmriAlmog, Patrick Chiang, "A piezoelectric energy- harvesting shoe system for podiatric sensing", Proceedings of IEEE 36th Annual International Conference of Engineering in Medicine and Biology Society (EMBC 2014), pp. 622-625, 2014.
- [3] Amata. Basari, SosukeAwaji, Shintaro Sakamoto, Seiji Hashimoto, Bunji Homma, Kenji Suto, Hiroaki Okada, Hideki Okuno, KojiroKobayashi, ShunjiKumagai, "Evaluation on mechanical impact parameters in piezoelectric power generation", Proceedings of IEEE 10th Asian Control Conference (ASCC), pp. 1-6, 2015.
- [4] ArvindAsha, Jilu Joy, S. Sreekalpa, S. Sujith, ResmiRamakrishnan, "Power Generation through Human Locomotion", Journal of Electronics and Communication Systems, vol. 1, no. 1, pp. 1-9, 2016.
- [5] JoydevGhosh, SupratimSen, AmitSaha, Samir Basak, "Electrical power generation using foot step for urban area energy applications", Proceedings of IEEE International Conference on Advances in Computing Communications and Informatics (ICACCI 2013), pp. 1367-1369, 2013.
- [6] 2017 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS).
- [7] Ashley Taylor and Tom krupenkin "Reverse electro wetting as a new approach to high power energy harvesting" Nature communication, pp 1-7 August 2011.



INNO  **SPACE**
SJIF Scientific Journal Impact Factor

**Impact Factor:
7.512**

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details