ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 4, April 2017

Power Harvesting Through Human Locomotion

Chandrika Gautam[1], Ayushi Dheeraj[2], Shelja Khirwar[3], Ashish Kumar Singh[4], Er. Nitin Agarwal[5]

B.Tech. Students, Dept. of ECE, R.B.S. Engineering Technical Campus, Bichpuri, Agra, India[1,2,3,4]

Assistant Professor, Dept. of ECE, R.B.S. Engineering Technical Campus, Bichpuri, Agra, India[5]

ABSTRACT:Early Discharging of smart phones batteries is a common issue. Though, there are so many additional alternatives present to charge the batteries without current connection of electricity i.e, by stored power viz. power bank. But power bank still needs electricity to charge itself by non-renewable source of energy. In this project we are using renewable source of energy through human locomotion via simply walking or running. In this project we are going to generate power. We are installing this system into shoe's sole, so when a person walk or run while wearing that shoes some force, strain and pressure will exert and this mechanical energy will convert into electrical energy by using piezoelectric sensor.

KEYWORDS: Piezoelectric sensors, Non-Conventional energy, Power Harvesting, Human Locomotion.

I.INTRODUCTION

In this paper we are representing the methodology of electrical power generation using the energy of human footsteps. This is about how we can generate electricity using human's waste foot energy and applications for the same. When human walk some force exerts on surface of shoe this force can be used to generate electricity. The idea of converting pressurize weight energy into the electrical energy is possible by piezo-electric sensors. The power generating shoes can be a major application if we use piezoelectric sensors as an energy converting material. The piezo-electric sensor have crystalline structure and ability to convert the mechanical energy (stress and strain) into the electrical energy. Whenever there is some vibrations, stress or straining force is exert by foot then these crystals eventually converts it into electric power which can be used for charging devices viz laptop, mobiles, electronic devices etc. In this project, we will work on generation of electricity in the area of power harvesting.

Now-a-days, soon discharged of smart phones batteries are a major problem and this problem is continuously increasing and will increase day by day. This new generation needs lots of energy for their different operations. Most of the human energy are wasted and in a large amount. There are various ways to generate electricity but the human bio-energy being wasted, if it can be made possible for utilization it will be very useful energy sources. The human waste foot energy is being use to produce electricity this would be a great evolution in generation. The average human can take 3,000 -5,000 steps a day. When we walk then some electricity of energy is wasted in the form of vibrations we can convert this energy or vibrations into an electrical energy using piezo-electric sensors. Harvesting of energy which means energy is already available, but is going to waste if not utilized. Embedded piezoelectric material can provide the magic of converting pressure exerted by the moving people into electric current.

In this project we are generating electrical power as non-conventional method by simply walking or running. Non-conventional system is very essential at this time to our nation. Non-conventional energy using foot step is converting pressure and vibrations exerted by the moving people into electrical energy by using piezoelectric sensor. In this conversion of force energy into electrical energy takes place.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 4, April 2017

II. RELATED WORK / LITERATURE REVIEW

There are several ways or methodologies to power harvest through footsteps technology. Some of them are as follows:-

(a) Siba Brata Mohanty, Sasank Shekhar Panda[1],proposed a methodology to generate power through footsteps as a source of renewable energy that can be obtained while walking on to the certain arrangements like footpaths, stairs, plate forms and these systems can be install elsewhere specially in the dense populated areas. In this the basic working principle of 'footstep power generation system' was based on the crank shaft and gear arrangement and fly wheel.

(b) Abhishek N, Shivasharan Yalagi. [2], gave an idea of power generation by footsteps using rack and pinion arrangement in which they described basic necessities regarding this modern world. In their project generated electrical power as non-conventional method by walking on the footsteps. They also described about Non-conventional energy system which is very essential at this time to developing nations like India, China etc. Non-conventional energy using footsteps needs no fuel input power to generate the output. In their project the conversion of mechanical energy into electrical energy is done by using simple drive mechanisms such as rack and pinion assembly and chain drive mechanism has been done.

(c) Sarat Kumar Sahu, Shubham Kumar, Pankaj Kumar Yadav and Rishav Kumar[3],gave an idea of generating electrical energy by means of a nonconventional method just by walking on the footsteps. Non-conventional systems for energies are very much required at this time. Energy generation using footsteps requires no any fuel input to generate electricity. In this project they generated electricity just with the help of rack and pinion arrangement along with alternator and chain drive mechanism .For its proper functioning such that it converts Force into electrical energy, the mechanism consisted of rack & pinion, chain drives, alternator and battery. We have discussed its various alternate applications with extension also. The power generation is much worthy but it has little initial cost effective factors.

(d) Alla Chandra Shekhar, B Murali Kishore, T Jogi Raju [4],generated electrical power as nonconventional method by simply walking or running on the foot step. Non-conventional energy using foot step is converting mechanical energy into the electrical energy. The main aim of their project was to develop much cleaner cost effective way of power generation method, which in turns helps to bring down the global warming as well as reduce the power shortages. In this technique the conversion of the force energy into electrical energy by using electromagnetic induction has been done in which control mechanism carries the copper coil and bar magnetic which is used to generate voltage, a rechargeable battery is used to store this generated voltage.

(e) V Jose Ananth, AP [5], designed rack and pinion arrangement for generating electricity while considering need and use of non-conventional energy.This arrangement consist of rack & pinion, D.C generator, battery and inverter control. So this project was implemented to all foot step, the power generation is very high but the drawback of this project was that its initial cost of arrangement was high.

(f) ArvindUpadhyaya, ShwetaUpadhyaya[6],was Proposed a Method to Generate Electricity through Power Stair . This attempts to show how energy can be used at a commonly used floor steps. The usage of steps in every building is increasing day by day. Even every small building has some floors. A large amount of energy wasted when we are stepping on the floor by dissipation of heat and friction, every time a man steps up using stairs, there is a great possibility of tapping this energy and generating power by making every staircase as a gear power generating unit. The generated power can be stored by battery and it will be used for lightening the building.

III. PROPOSED TECHNIQUE& METHODOLOGY OF POWER HARVESTING THROUGH HUMAN LOCOMOTION

After considering all the above techniques, we have designed a system that aims to harvest the waste energy produced by human during walking or running using piezoelectric sensorsand arduino-nano single board microcontroller which is used for interfacing. The proposed system is very useful for charging mobiles as this system is implemented inside shoes's sole so it is easily affordable to everyone and charging of mobiles can be done easily by connecting it with USB port of the system.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 4, April 2017

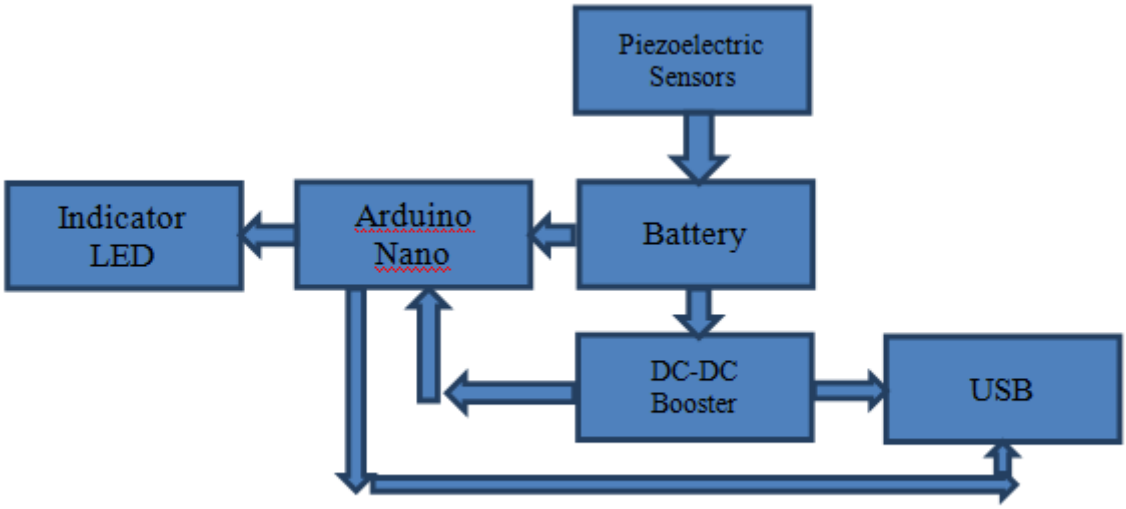


Figure1: Block diagram of Power Harvesting Through Human Locomotion

METHODOLOGY

Piezoelectric Sensors

The prefix Piezois Greek for 'Push' Piezoelectric sensors are one of the small scale energy source. It is a device that uses the Piezoelectric effect, to measure changes in pressure, acceleration, temperature, strain or force by converting them into an electric charge.Piezoelectric Effect is the ability of certain materials to generate an electric charge in response to applied mechanical stress.

Fig 1(a): Piezoelectric Sensor

We arranged these piezoelectric sensors in parallel form initially by joining its positive terminal to positive terminal and negative terminal to negative terminal. Similarly, we prepared seven layers of this combination and arranged these seven layers in series combination. The produced output voltage is in the form of AC. Then it can be converted to DC by passing it through Rectifier circuit. The converted DC voltage can be fed into DC-DC Booster circuit.

Bridge Rectifier

We have used bridge rectifier so that the output coming from AC form can be converted into DC form.

Battery

Here,we have used 3.7v LIPO battery to store chage.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 4, April 2017

Fig 1(b): Battery

DC-DC Booster circuit

This circuit is used to amplify the voltage level coming out from battery.

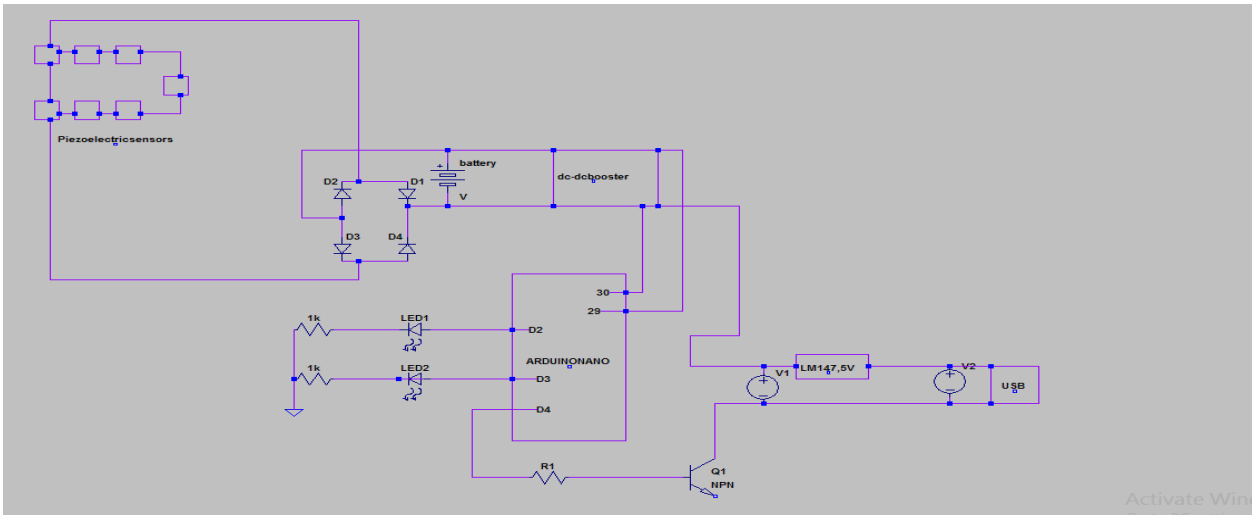
Arduino Nano

It is used for interfacing two LEDs, one is Red which blinks when circuitary gets on and another gets blink when battery starts getting charging. Then through USB port, USB cable is put in then the phone starts getting charge.

Fig 1(c): Arduino Nano

IV.CIRCUIT DIAGRAM & WORKING

We designed this circuit of power harvesting through human locomotion in LT-Spice software.



A number of 14 piezoelectric sensors are used in which 7-7 piezoelectric sensors are arranged in parallel combination by forming 2 layers. These two layers are arranged in series combination. The pressure applied on piezoelectric sensors is in the form of pulse i.e, ac. Then it is connected to bridge rectifier which is used to convert this output into dc. The charge will then store in capacitor and then go to battery. Battery will charge upto 290mah. There will be some losses occur then this voltage will go to the dc-dc booster. DC-DC booster is used to boost up the voltage upto 5V. Then the output of dc-dc booster is then trasnffered to arduinonano, which is the input of arduinonano.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

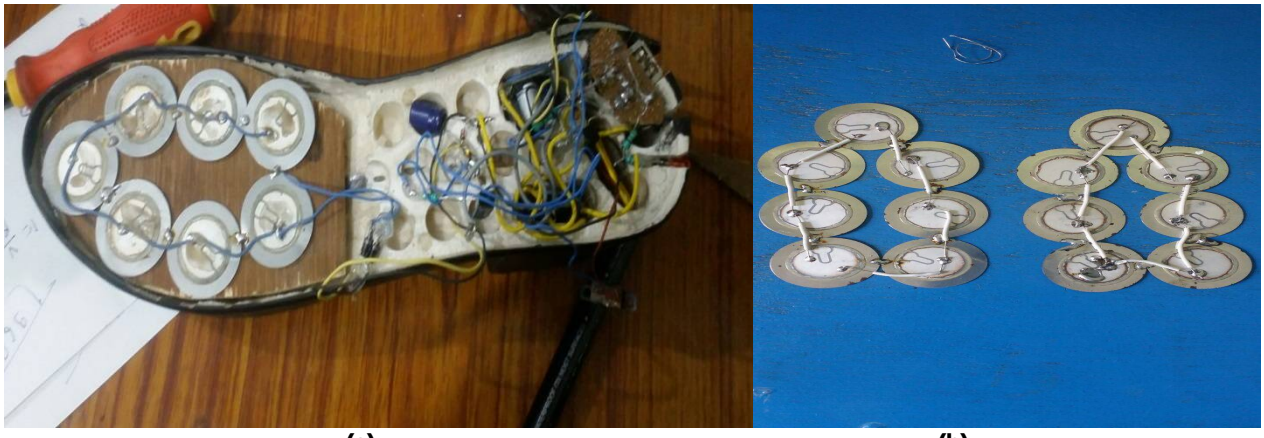
Vol. 6, Issue 4, April 2017

V. OBSERVATION &RESULT

After completion of the hardware and software, we observed following calculations:

No. of Steps Covered	Time Taken to Charge Phone
15	5 sec
8600	1720 sec
1.5km	28 min

After using the system we have observed that when a person covers approximately 1.5km distance while wearing this type of show which has such type of system implemented in its shoe sole then upto approximately anybody can charge their mobile phone.



(a) (b)

Figure 3: Designed hardware image (a)circuitary in shoe sole (b)arrangement of piezoelectric sensors

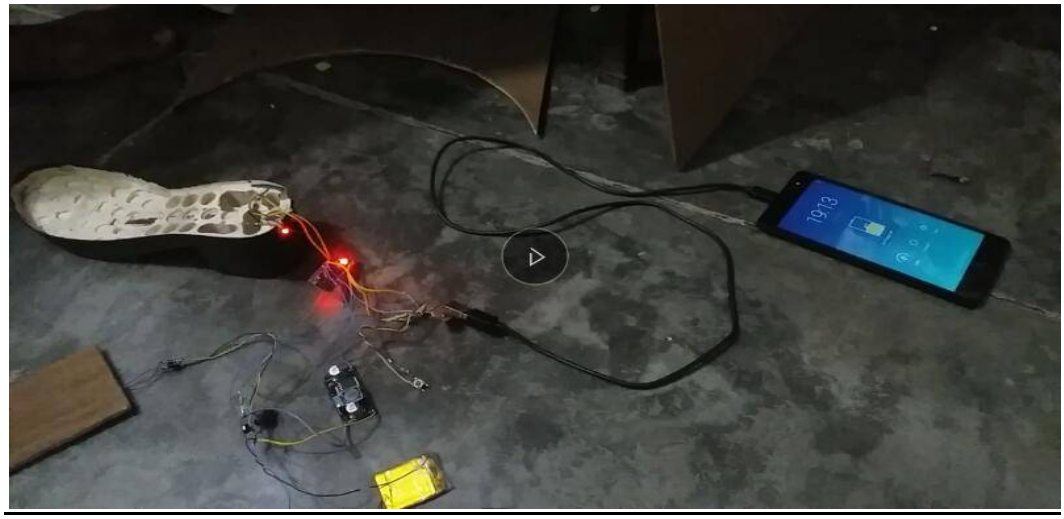


Figure 4: Designed hardware's working image with connected phone while charging

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 4, April 2017

We have implemented the circuit successfully. As we open the main switch the red LED will be ON then, we applied pressure on sensors and hence battery starts getting charge and once the battery gets charged upto certain level then blue LED will be in ON state, then we will be connected the USB cable to mobile through USB port and then mobile phone will start charging. And thus, the output is demonstrated successfully.

VI.CONCLUSION& FURTHER RECOMMENDATIONS

In this paper, the proposed technique i.e. power harvesting through human locomotion has been discussed and its application for power harvesting is successfully demonstrated. The system is cheap, eco-friendly, and easy to install. However, this system is applicable to generate power using piezoelectric sensors but it generate small amount of power at a time. The same concept can be extended further to generate more power by using the more amount of higher efficient piezoelectric sensor and by using enhanced integrated circuitary in stationary crowded place.

REFERENCES

[1]. SibaBrataMohanty, Sasank Shekhar Panda. “An Investigation of Generation of Electricity using Foot Step”- International Journal of Engineering Sciences & Research Technology, May 2014.
[2]. Abhishek N, ShivasharanYalagi. “Power Generation by Foot Steps using Rack and Pinion Arrangement”- International Journal of Engineering Research & Advanced Technology, vol.2, Issue 1, May 2016.
[3]. Sarat Kumar Sahu, Shubham Kumar, Pankaj Kumar Yadav, Rishav Kumar. “Foot Step Power Generation”- International Journal of Mechanical Engineering and Technology, vol.7, Issue 2, pp.187-190, March-April 2016.
[4]. Alla Chandra Shekhar, B Murali Kishore, T Jogi Raju. “Electromagnetic Footstep Power Generation”- International Journal of Engineering Sciences & Research Publication, vol.4, Issue 6, June 2014.
[5]. V Jose Ananth, AP. “Power Generation using Footsteps”- International Journal of Engineering Trends and Technology, vol.1, Issue 2, May 2011.
[6]. S.S.Taliyan, B.B. Biswas, R.K. Patil and G. P. Srivastava, Reactor Control Division, Electronics & Instrumentation Group And T.K. Basu,“Electricity from Footsteps”-Research Article of General Interest, issue 313, March-April 2010.
[7]. ArvindUpadhyaya, ShwetaUpadhyaya, “A Proposed Method to Generate Electricity through Power Stair”-American Journal of Engineering Research (AJER)e-ISSN: 2320-0847 p-ISSN: 2320-0936 Volume-5, Issue-6, pp-20-23, 2016
[8].Mr.A.Adhithan, K.Vignesh, M.Manikandan, “Proposed Method of Foot Step Power Generation Using Piezo Electric Sensor”-International Advanced Research Journal inScience, Engineering and Technology, vol. 2, Issue 4, April 2015
[9]. K. Ramakrishna, GuruswamyRavana, VenuMadhavGopaka, “Generation of Electrical Power through Footsteps”-International Journal of Multidisciplinary and Current Research, vol.2, Sept-Oct 2014
[10]. Shiraz Afzal, FarrukhHafeez, “Power Generation Footstep”- International Journal of Advancements in Research & Technology, Volume 3, Issue 4, April-2014