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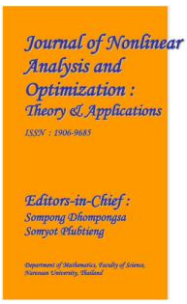

PIEZO DETECTORS-BASED EFFECTIVE HUMAN FOOTSTEP PIEZOELECTRIC TILE POWER GENERATION

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ABSTRACT
This design displays a step-grounded power production scheme employing readily accessible piezoelectric detectors. Since the time when the mortal race first appeared on this planet, they have needed energy at a veritable breakneck pace for both survival and good, and as a result, the power infrastructure has become depleted. Then, we provide an enhanced step power generator system that generates electricity from mortal steps using piezo detectors. The creation of new energy sources is a top priority during this time of technological advancement. Bias that is suited for converting ambient energy into electrical energy is one of the domains that has attracted significant interest. Our idea aims to create a tool that can transform pressure into grounded electrical energy using a piezoelectric element. This design will also show that the presence of waste vibration energy might have some values to be used. The system of this energy generating design includes the conversion of nonstop contraction of bottoms by mortal pressure across piezoelectric accoutrements into electrical energy.

1. INTRODUCTION
Electricity has now become a vital resource for the human population. Alternative energy sources and their sustainable use were motivated by worries about the energy gap between supply and demand. A mechanism to generate power from the growing population was developed as a result of the linear increase in the mortal population and the demand for energy.

The ability to perform the task is all that energy is. The most often used energy source in daily life is electricity. The demand for energy is growing today, which is essential for human survival. Due to the large amount of energy resources that are generated from resources like water, wind, etc., it is necessary to develop large industries at a high cost of conservation some other energy coffers are also expensive and generate pollution. Electricity has come important coffers for mortal being hence it's demanded that wasted energy must have to use walking is the most common exertion done by mortal being, while walking energy is wasted n the form of vibration to the face and this wasted energy can be converted into electricity. Using the star called piezoelectric effect. Piezoelectric effect is the effect in which mechanical climate pressure or strain applied to piezoelectric material is converted into electrical form. This design gives about how energy is used on stepping on stairs. The use of stairs in every structure is adding day by day indeed small structures have some bottoms when we're stepping quantum of this wasted energy is employed and converted to electricity by piezoelectric effect. Piezoelectric effect is the effect of specific accoutrements to induce an electric charge in response to applied mechanical stress. Energy harvesting or scavenging is the process of landing the wasted energy from naturally being energy sources, accumulating and storing it for after use.

Now a day’s energy is one of the most important issues around the world. Especially in Bangladesh energy extremity is a big problem. Renewable energy sources can be a great media to break this energy extremity problem in Bangladesh. As we know natural resources will finish one day. That’s why researchers are trying to introduce cover energy sources from nature. That must be green and not dangerous for the atmosphere. Energy harvesting is defined as acquiring jiff amounts of energy from

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one or further of the girding energy sources. mortal beings have formerly started to use energy harvesting technology in the form of windmill, geothermal and solar energy. The energy came from natural sources, nominated as renewable energy. Renewable energy harvesting shops induce kW or MW position power; it's called macro energy harvesting technology. also, micro energy also can produce from those natural sources that are called micro energy harvesting. For an illustration, in the Netherland, the electromagnetic creator is applied on the dance bottom to induce electricity. still, a fairly larger divagation of bottom over to 10 mm is demanded to induce conspicuous electric energy. also, it's have a complex structure and demand in high assembling cost. In Japan, the piezoelectric transducer had been installed in the bottom of the sanctum ticket machine to induce electricity and only need piezoceramic without any complex mechanical structure.

This day utmost of the exploration in the energy field is to develop sources of energy for future. It's time to find renewable surceases of energy for the future. Piezoelectric accoutrements are being more and more studied as they turn out to be veritably unusual accoutrements with veritably specific and intriguing plots. In fact, there accoutrements have the capability to produce electrical energy from mechanical energy for illustration they can convert mechanical geste like vibrations in to electricity. similar bias are generally applied to as energy harvesters and can be used in operations where outside power is unapproachable and batteries aren't a doable option. While recent trials have shown that these accoutrements could be used as power originators, the quantum of energy produced is still actually low, hence the necessity to optimize them.

Piezoelectric accoutrements have two tracts that are define as direct and converse effect. Direct effect is the property of some accoutrements to develop electric change on their face when mechanical stress is exercised on them, while converse effect is the property of some accoutrements to develop mechanical stress when an electric charge is convinced.

Numerous exploration groups are laboriously working in the area of step power generation using piezoelectric methodology.(1) Arvind etal., proposed a power generation through mortal locomotion. Yaramasuetal., proposed high power wind energy discussion system as an arising technology using same technology(2). Taghavi and Andrew Stinchchombeetal., proposed a tone- sufficient wireless transmitter powered by bottom pump urine operating variable(3). Ghosh etal., proposed electrical power generation using step for civic area energy operation(4). Meireretal., proposed a piezoelectric energy harvesting shoe system for podiatric seeing(5). Pedchenko and AlexanderV. etal., proposed logical tools for probing stability and power generation of electromagnetic vibration energy of harvesters(8). Others(6- 7) proposed step generation through walking and its mechanical impact during piezoelectric operations.

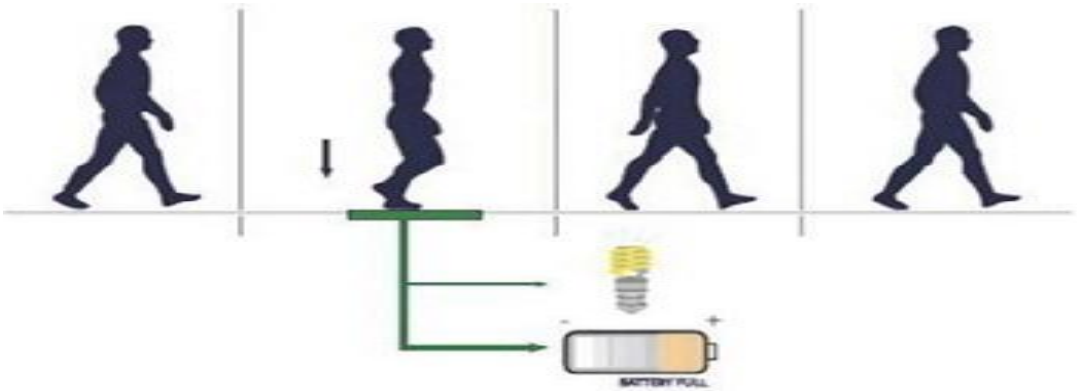

Fig.1: Footstep energy harvesting

2. RESEARCH METHOD

In this paper use of piezoelectric glass is to induce electric thing from compassing vibration. Piezoelectric stuff have liquid structure. They can convert kinetic energy into electrical energy and vice versa. The produced electrical energy from piezoelectric glass is actually low in the order of 2-3 volts and is stored in battery to charge regulator, since it isn't possible to charge 12v battery through plate clear affair. We've used more number of detectors to significantly increase the voltage.

Electricity has turn lifeline for earthborn population. Demand of electricity is extending day by day.

Some technology needs high measure of electrical power to perform varied operations. As we know electricity is generated by some sources like water, wind etc. To induce electricity from these sources, development of big manufactories or big factories is demanded having high conservation cost. As the use of energy is increases, noofenergyresourcesaregeneratedandwasted.However, we will face completely absence of energy, If the destruction of energy is rapidly increases also one day will come at that time.

This technology is predicated on principle of piezoelectric effect which has capability to make up electrical charge from pressure and strain applied to them. Piezoelectric tile belong to group of ferroelectric material. Piezoelectric tile like PbTio3, PbZr03,PVDFandPZT.Most generally available piezoelectric glass are PZT and PVDF.

Study of Connections

A force sensor and voltmeter is connected to this series combination. Voltage and current generated across the series connection is measured. The voltage and current generated across the alike connection is measured. From series connection gained current is poor and from alike connection acquired voltage is poor. To overcome this problem rectifier in series-corresponding connections issued.

Working

Piezoelectric material converts pressure into electrical energy. The pressure can be also from weight of moving vehicles or from the weight of people walking on it.The produced work is in the variable form .Sorectifier circuit is used to convert variable voltage into direct voltage and it is stored in rechargeable battery. Two possible connections were tested-parallel and series connections for producing 40v work. The voltage produce across the time can be displayed on Display.

A piezo glasssuitable of generating 40v.The weight applied on the glass and corresponding produced voltage is related and direct relations introduce.

Piezoelectric effect:

They also use piezoelectric glass. The piezoelectric crystal exhibits the piezoelectric effect. This piezoelectric effect having two unique ideas. First one is the direct piezoelectric effect which means that material has capability to convert mechanical strain into electrical charge. Alternate 1 is the converse effect, in the applied electrical voltage converted into mechanical strain energy. That means material used as power harvesting medium.

Working

This system arranged for the requirement of taking 230v AC from 12v DC input. After this a voltage regulator 7805 feds the microcontroller which is used to control the liquid display and other factors presented. This input signal given to DC to battery to store the produced energy. Also the 12v is given to another voltage controller 7805 for 5v output to the loads. This stored energy also employed by the loads connected like LED's, USB bias. The glass display will gives the voltage generated for every step and the step count

Principle

The principle of the working of this system is conversion of pressure from kinetic way into electrical work. The measure of electrical work depends upon the pressure by the weight of person walking on the ground.

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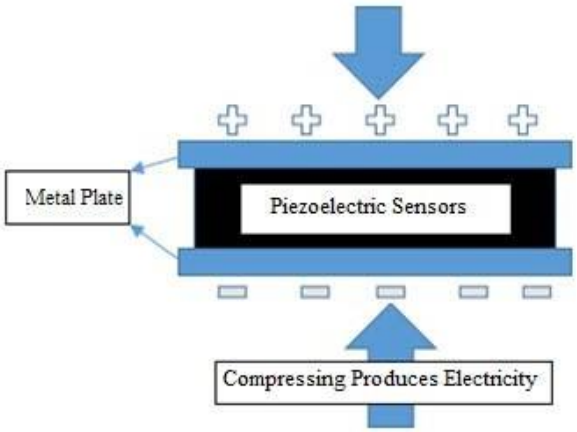

Fig.2.Piezoelectricmechanism.

Construction and Working

The system consists of blocks that depress slightly under pressure of man nethermost and which will depress the piezo transducer setup placed right now after it inside the system. This consists of piezo transducers low platform and compressible top platform. System also consists of weighting platform, voltage controllers, microprocessor, LEDs, liqiud display and diodes. When people walk on the bottom, the piezo electric transducers converts mechanical pressure into the voltage directly as the property of a piezo electric transducer is that to produce electrical work at its terms and also the electric current and power is realized. When the pressure is applied through aundermost step, ninety-five percent of the pressure applied is converted into energy in this system.

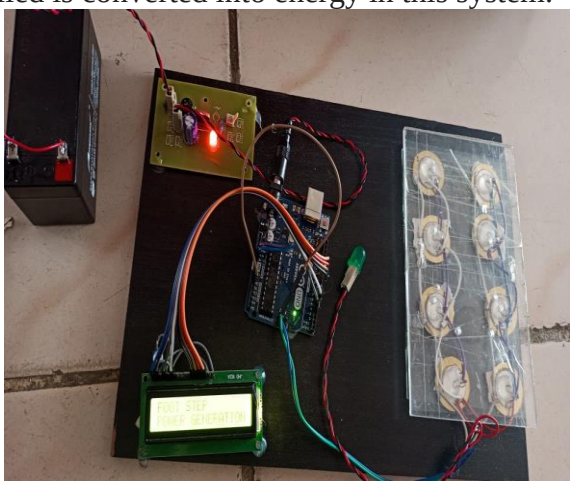

Fig.3 :Construction ofpiezoelectric footstep power generation

BLOCK DIAGRAM

As the work voltage from a single piezo- film was extremely low, thus combination of more piezoelectric is used. Two types ' possible connections can be done likewise connections and series connections. The affair of the piezoelectric material is not a regulated one, so variable to direct voltage conversion circuit ground is used and also it can be pass through regulator in order to regulate. The work of the voltage regulator is given to the unidirectional current controller. Unidirectional current controller means it allows incoming of current in only one direction. The below block illustration provides an structure of this design which includes main factors as piezoelectric sensors, Microcontroller, display display, Voltage regulators, and rechargeable battery. each factors has its own significance in the working of this design.

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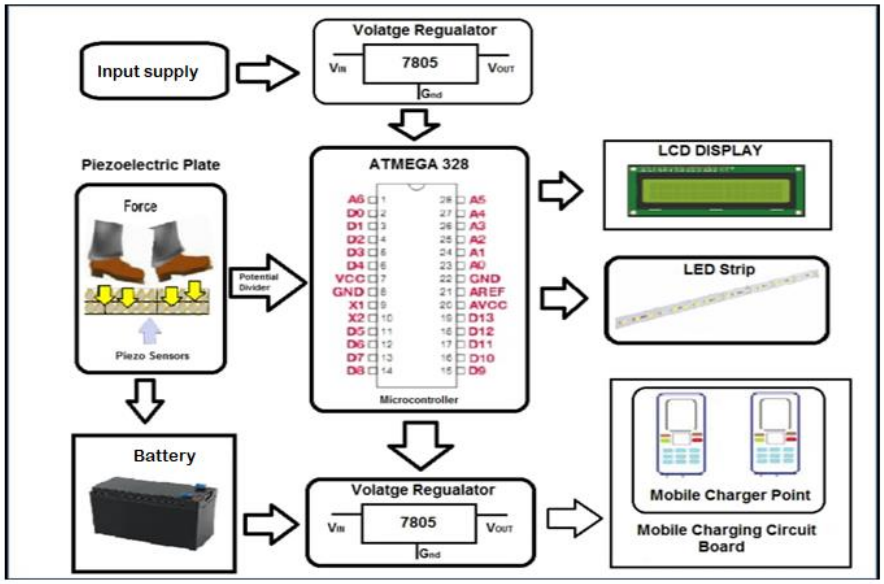

Fig.4 : Block Diagram of footstep power generation

Substantially used unidirectional current regulator bias are as follows Diode- we previously know that it allows an electrical current in one direction. It acts like a switch. A specific diode converts AC into partially DChence occasionally it also called as bridge. Thyristor- A thyristor is four- level semiconductors that are frequently used for handling large measure of power. While a Thyristor can be turned on or off, it can also regulate power using being called phase angle control. Atmega328- A microcontroller Atmega328 is used in this system to control the bias connected in the circuit. Also, the LED strip and USB node is connected to the microcontroller to glow the LED and to supply the power to the loads through USB. The work voltage from this piezoelectric is also stored in a battery. liquid form is used for displaying generated voltage. For this purpose, microcontroller Atmega328 is used. The microcontrollers correspond of crystal clear oscillator and which is used for its operation. The affair of the microcontroller is also given to the liquid which also displays the voltage situations. From this system we're generating energy by man steps using the piezoelectric effect. This idea not only overcome the energy heads problem but also helps to maintain the eco-friendly surroundings for generating energy.

FLOW CHART

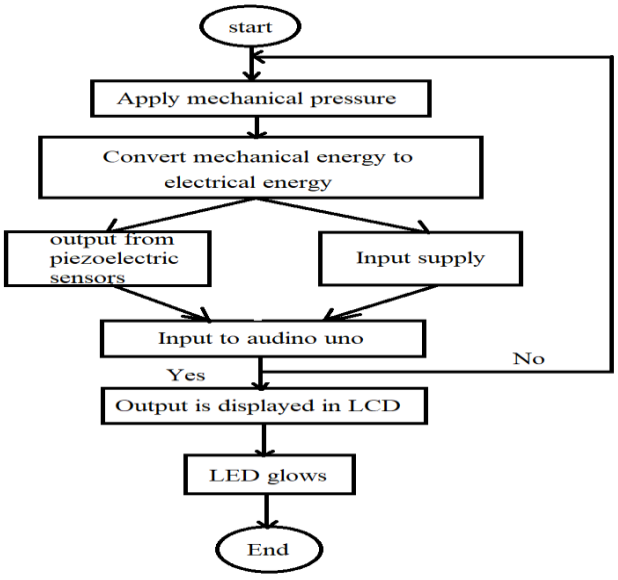

Fig.5 :Algorithm of piezoelectric footstep power generation

RESULTS AND ANALYSIS

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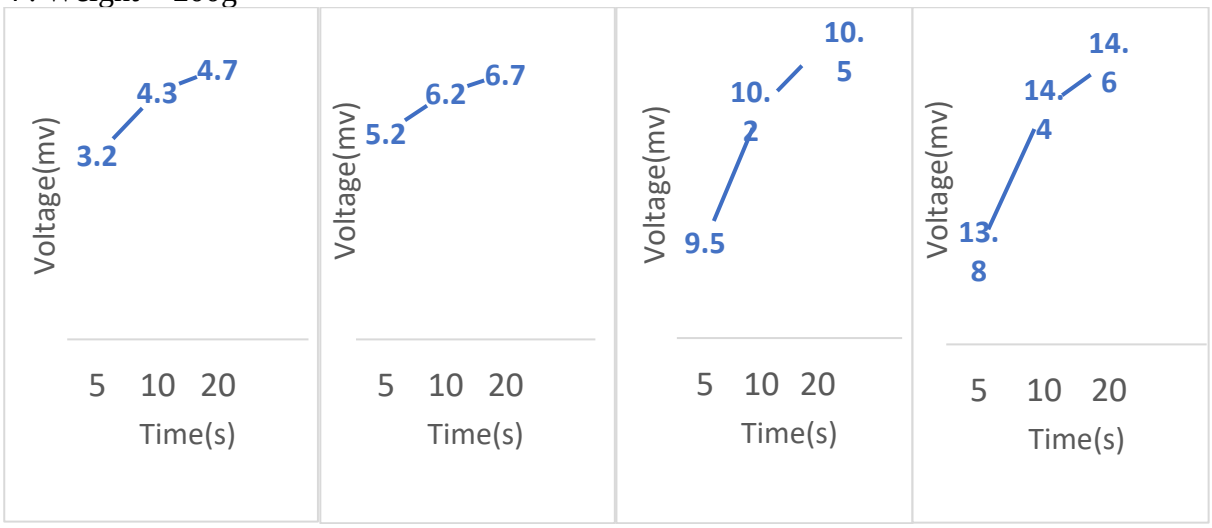
V-I characteristics (as in Figure 5) of both the piezoelectricmaterial under consideration were studied to understand theoutput corresponds to the various pressure and strain appliedon them.Asdifferentobserved pressure and strain are tested on the piezoelectricmaterial, different voltage readings were noted correspondingto thedifferent pressure andstrain.

Table 1:TheWeightandtheVoltageTakenbasedontheJumpon thePiezoelectric

Subject	Weight(kg)	Time(sec)			
		5sec	10sec	15sec	20sec
Subject 1	50	3.12V	4.32V	4.80V	5.78V
Subject 2	100	5.2V	6.2V	6.38V	6.72V
Subject 3	150	9.5V	10.2V	10.66 V	10.75 V
Subject4	200	13.8 V	14.4V	15.31V	15.61 V

Study using Bottom press or pumping is conducted to determine the voltage product of a 6 cell of the piezoelectric transducer that connected in series- alike connection. Table 1 shows subject with 50 kg, 40 kg, 35 kg and 30 kg body weight are used to test the piezoelectric crystal. They're asked to step on the crystals to do the bottom press or pumping conditioning to test the voltage generating capacity of the piezoelectric crystal. Figure 5 shows that when the piezoelectric are connected in series the work voltage is high but the work current is low. It gives high current but low product voltage. In order to answer this problem, the combination of this connection needs to carry out. Two set of three piezoelectric transducers that connected in series was attached together in alike to form series- alike connection. The value of voltage as well as current work are both satisfactory.
Subject 1 : Weight = 50g Subject 2 : Weight = 100g Subject 3 : Weight = 150g Subject 4 : Weight = 200g



Graph: Voltage vs Time

Figure 5. Voltage – Current graph of parallel andseries connectionofpiezoelectric

Figure 5 shows that when the piezoelectric are connected in series the product voltage is high but the product current is low. still, vice versa happed for the alike connection of the piezoelectric transducer. It gives high current but low product voltage. In order to break this problem, the combination of this connection needs to carry out. Two set of three piezoelectric transducers that connected in series was attached together in alike to form series- alike connection. The value of voltage as well as current both are satisfactory.

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CONCLUSION

When the time taken is longer, a piezoelectric crystal can produce more voltage. More steps are done and more force is exerted to the crystal plate the longer it takes. The voltage produced and the amount of time required has a direct relationship established. These piezoelectric devices are particularly well suited for use in congested areas like sidewalks, railroad ticket windows, stairwells, and dance floors. The workout crystal, which is comparable to that used for skipping or on a routine, can also, be made using a piezoelectric crystal.

REFERENCES

[1]Arvind,Asha,JiluJoy,S.Sreekalpa,S.Sujith,andResmiRamakrishnan"PowerGenerationthroughHumanLocomotion,"JournalofElectronicsandCommunicationSystems, vol.1,no.1,pp.1-9,2016.

[2]. "Footstep Power Generation Using Piezoelectric Transducer", " Kiran Boby, Aleena Paul K, Anumol.C. V, NimishaK.K.", International Journal of Engineering and Innovative Technology, vol.3, Issue 10, April 2014.

[3]. "Power Generation from Staircase (steps)", " Ramesh Raja R, Sherin Mathew ,,, International Journal of Innovative Research in Science Engineering and Technology, vol.3, Issue 1, February 2014.

[4]. "Power Harvesting by Using Human Foot Step", " Prabaharan R, Jayramaprakash A, Vijay Anand. "International Journal of Innovative Research in Science Engineering and Technology, vol.2, issue 7, July2013. [4]. "Power Generation using Footstep", " Jose Ananth Vino, AP.", International Journal of Engineering Trends and Technology, vol.1, issue 2, may 2011.

[5]. "Electricity from Footsteps", S.S. Taliyan, B.B. Biswas, R.K. Patil and G. P. Srivastava, ", Reactor Control Division, Electronics & Instrumentation Group, Issue 21, August 2010.

[6] Nitashree,et.al.,"FootStepPowerGenerationUsingPiezoelectricMaterial,"InternationalJournalofAdvanceResearchinElectronicsandCommunicationEngineering,vol.4,pp.2503-2506,Oct2015.

[7] D.Marshiana,etal.,"FootstepPowerproductionusingPiezoelectricSensors,"ResearchJournalofPharmacyand Technology,vol9, pp. 831-834, Jul 2016.

[8] V.Panneerselvam,etal.,"PortableDCRegulatedPowerSupplyfromFootsteps,"InternationalJournalforScientificResearch&Development,vol5, pp.916-918,April 2017.

[9] R.Prabaharan,et.al.,"PowerHarvestingByUsingHumanFootStep,"InternationalJournalofInnovativeResearchinScience,EngineeringandTechnology,vol2, pp3001-3009, Jul 2013.

[10] P.Madhu,etal.,"ElectricalPowerGenerationbyFoot-stepsusingPiezo-electricTransducers,"InternationalJournalof RecentTrendsinEngineering&Research(IJRTER)vol. 2pp108–115, June2016.

[11] C.Gautam,et.al.,"PowerHarvestingThroughHumanLocomotion,"InternationalJournalofAdvancedResearchinElectrical,ElectronicsandInstrumentationEngineering,vol6,pp.2277-2282,April 2017.

[12] R.M.MahidurandR.Sarker,"VibrationBasedPiezoelectricEnergyHarvestingUtilizingBridgelessRectifierCircuit,"JournalKejuruteraan, pp.87-94, 2016