International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 03 | Mar 2020 www.irjet.net p-ISSN: 2395-0072

EFFICIENT ENERGY HARVESTING AND REUSING SYSTEM

Thirumurugachandar M[1], Suvetha S[2], Sankari M[3], Dr. Amali C[4]

[1,2,3]UG Students, Department of Electronics and Communication Engineering, SRM Valliammai Engineering College, Kattankulathur, Chengalpet-603203, Tamilnadu, India
[4]Assistant professor, Department of Electronics and Communication Engineering, SRM Valliammai Engineering College, Kattankalathur, Chengalpet-603203, Tamilnadu, India

---

Abstract- *In present scenario, energy, and power plays a major role in the human life to meet their basic needs and necessities which results in exhaustion of energy resources. This paper is all about generating electricity when people walk on the floor using the piezoelectric sensor. Think about the forces you exert which is wasted when a person walks, so this idea is to convert the weight energy into electrical energy and can be stored for future use. Main motto of this paper is to face the energy crisis which is the main issue in the world.*

Key Words: Piezoelectric sensor, Weight energy, Electrical energy, Energy crisis.

1. INTRODUCTION

Nowadays, electricity is the necessary part of human life in everyday activities and demand of electricity is increasing exponentially day by day. Due to this, the paper presents the design of power generation using foot step based on piezoelectric sensors. In this technology, the formation of electrical energy from the force exerted by foot step on the floor illustrated. It will be surprising to know that a normal foot step moment on the floor can generate how much energy.

Thousands of step per day is taken by each person. It is a fact that large amount of energy has lost by each person during routine walk which is the main source for this system. The energy that is produced from a person walking on floor is noise and pollution free. That type of energy is advantageous and even not need any type of fuel or power source to run.

By implementation of this renewable energy in today's world while the demand of energy is increasing day by day, is the current solution of this modern world. In this paper, a system is designed which generate power through non-conventional energy source technique. This system is established in heavy populated areas such as railway station, college, temples, shopping malls, etc.

2. LITERATURE SURVEY

Here, they propose a pavement block piezoelectric energy harvester (PBPEH) that can be installed in an actual walkway. They developed an IOT system that can power the signal indicator and also collect environmental data near the walkway utilising the PBPEH without a battery [1]. When a pedestrian steps on the top plate of the device, the plate dip down slightly due to the weight of the pedestrian. Due to this downward movement, the shaft of an electrical alternator fitted in the device rotates and produces electrical energy [2]. Proposed the way by which electrical energy is generated by piezoelectric sensors which are placed on the roads where regulator, inverter and converter circuits are used for energy generation [3]. A regenerative energy resource by using rack and pinion gear system by dynamo flirting with its gear mechanism was discussed in [4]. Here, a technology was discovered to generate electricity from speed breakers and this method serves to conserve our natural resources [5]. Recently, energy harvesting technologies is developed using a microcontroller based boost converter and photo sensor to sense day or night condition. This system aimed at storing the energy generated during daytime in batteries and can be used during night [6].

Here, when people walk across by the piezoelectric tiles, it will generate small electrical energy, this energy is also known as piezoelectricity. It can be implemented in densely populated area, footpaths, platform as a tile so that it can generate electrical energy from human pressure [7]. They developed an Unobtrusive devices at the MIT media lab scavenge electricity from the forces exerted on a shoe during walking. A flexible piezoelectric foil stare to harness sole-bending energy and a reinforced PZT Dimorph to capture Heel-strike energy, discussed in [8]. Here, they present an effective way of power generation method in which conversion of the force energy into electrical energy by using electromagnetic induction [9]. They proposed a method to generating electricity just with the help of rack and pinion arrangement along with alternator and chain drive mechanism [10]. Here, they designed a novel-mechanical to

electrical energy conversion method based on the reverse electrowelding phenomenon. It is achieved through the interaction of arrays of moving microscopic liquid droplets with novel nanometer-thick multilayer dielectric films [11].

3. PROPOSED SYSTEM

The proposed system focused on generating electricity using foot step in a renewable way and storing it for future usage. Piezoelectric sensor is connected in serial fashion and the rubber plate fixed above the piezoelectric sensor increases the amount of pressure which can enhance the system. The source of pressure is from the weight of the people walking over it. Whenever the force is applied on the piezoelectric sensor, the kinetic energy is generated .Then, this kinetic energy is converted into electrical energy using dynamo. The output of the piezoelectric material is alternating hence we prefer full wave bridge rectifier circuit. The Working and operation of a full wave bridge rectifier is pretty simple which makes use of both half cycles of input alternating voltage and converts them into direct voltage. Hence, it is much more efficient than half wave rectifier. Then this direct voltage is given to boost converter which is used to convert low voltage dc into high voltage dc. The output voltage from the converter is stored in the battery. An inverter is used to convert the dc voltage stored in the batteries to ac voltage for the purpose of connecting ac load. The produced voltage can be seen in a LCD. For this purpose microcontroller is used. We are using the conventional energy charging unit for giving supply to the circuitry.

4. SYSTEM MODEL

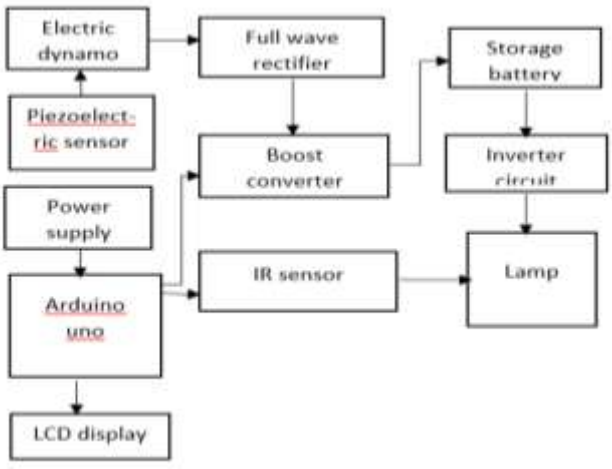

Fig.1 Block diagram

5. CIRCUIT DIAGRAM

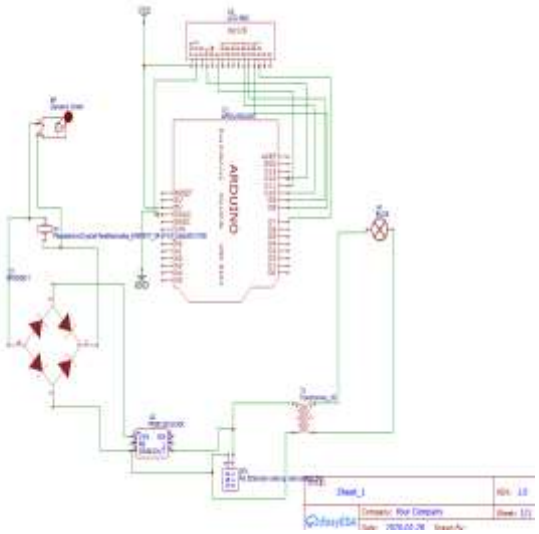

Fig.2 Circuit connection of the project

In this project, we are establishing connection of piezoelectric sensors to obtain a reasonable voltage. When human puts pressure is applied it is sensed by the piezoelectric sensor and the kinetic energy from the foot pressure is converted to electrical energy by means of electric dynamo. The full wave bridge rectifier converts the AC current to DC and those DC current gets boosted by means of boosted converter which boost the low DC voltage to high DC voltage and get stored in lithium battery. The stored DC voltage gets converter into 220 to 230 volt AC with the help of sin wave inverter. 230 AC is used in working of light, AC, fan, etc. The arduino UNO microcontroller controls and the amount of boosted DC voltage and displays in LCD. The power for LCD is given by 9V power supply.

6. OPERATIONAL SPECIFICATION

A. LCD 16*2

- Operating Voltage is 4.7V to 5.3V.
- Current consumption is 1mA without backlight.
- Alphanumeric LCD display module, meaning can display alphabets and numbers.
- Consists of two rows and each row can print 16 characters.
- Each character is build by a 58 pixel box.
- Can work on both 8-bit and 4-bit mode.
- It can also display any custom generated characters.

B. Arduino UNO

The 14 digital input/output pins can be used as input or output pins by using pin Mode (), digital Read () and digital Write () functions in Arduino programming. Each pin operate at 5V and can provide or receive a maximum of 40mA current, and has an internal pull-up resistor of 20-50 Ohms which are disconnected by default. Out of these 14 pins, some pins have specific functions as listed below:

- **Serial Pins 0 (Rx) and 1 (Tx):** Rx and Tx pins are used to receive and transmit TTL serial data. They are connected with the corresponding ATmega328P USB to TTL serial chip.
- **External Interrupt Pins 2 and 3:** These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- **PWM Pins 3, 5, 6, 9 and 11:** These pins provide an 8-bit PWM output by using analog Write () function.
- **SPI Pins 10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK):** These pins are used for SPI communication.
- **In-built LED Pin 13:** This pin is connected with a built-in LED, when pin 13 is HIGH – LED is on and when pin 13 is LOW.

C. Piezoelectric crystal

- Impedance:≤500Ω;
- Voltage:≤30Vp-p;
- Operating temperature:-20℃~+60℃
- Strain sensitivity: 5V/με
- Material: Quartz (mostly used).

D. Boost convertor

- Input Voltage: 12v – 15v DC.
- Output Voltage: 12v – 60v DC.
- Output Current: 6A MAX.
- Input Current: 10A (MAX).
- Full-Load temperature: 45 degrees.
- No-load current: 25mA typical.

E. Ac-Dc inverter

This is a quite simple DC to AC inverter that provides 220VAC when a 12VDC power source is provided. It can be used to power very light loads like night lamps and cordless telephones, but can be modified into a powerful inverter by adding more MOSFETs. It uses 2 power IRFZ44 MOSFETs for driving the output power and the 4047 IC as an astable multivibrator operating at a frequency of around 50 Hz. The 10 and 11 pin outputs of the IC directly drive power MOSFETs that are used in push-pull configuration. The output transformer has a 9V-0-9V, 2 Amps on the secondary and 230V on the primary.

F. DC motor (dynamo)

30 RPM Side Shaft 37mm Diameter Compact DC Gear Motor is suitable for small robots / automation systems. It has sturdy construction with gear box built to handle stall torque produced by the motor. Drive shaft is supported from both sides with metal bushes. Motor runs smoothly from 4V to 12V and gives 30 RPM at 12V. Motor has 6mm diameter, 22mm length drive shaft with D shape for excellent coupling.

7. EXPECTED RESULTS

Power =Voltage *Current

Table.1 Applied weight and their output power

Power Weight(Kg)	Power(mW)
40	0.045
45	0.055
50	0.06
55	0.065
60	0.07
70	0.082
75	0.009

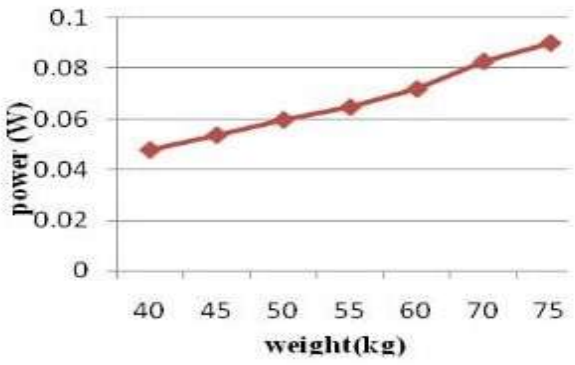

Fig.3 Weight Vs Power

8. CONCLUSION

Footsteps are the main source of power generation. There is no need of energy from conventional source of energy and there is zero percent of pollution in this type of power generation. There is no need of any kind power from mains and it is important to the areas, all tracks where footsteps are used to generate non-conventional energy such

as electricity. The contribution of non-conventional energy to our primary energy is 11% that is a common fact. This will form a sound global environmental damage.

9. REFERENCES

[1] Gyeonge Ju Song, Jay Yong Cho, Kyung-Bum Kim, Ye Won Song, Tae Hyun sung[2019] ,"Development of a pavement block piezoelectric energy harvester for self powered walkway application in applied energy" 256:113916,

[2] Taliyan.S.S."Electricity from footsteps in IEEE on power generations", Vol 23.no.4, pp. 2521-2530, April 2010.

[3] Siti Sarah Mat Isa. [2013],"Footstep power generation system", Technical report, Vol.10.13140/2.1.491.9448.

[4] Tom Jose V, Binoy Boban, Sijo M T,"Electricity Generation from footsteps" in International Journal of Scientific and Research Publication, Volume 3, Issue 3, March 2013.

[5] Aniket Mishra, Pratik Kale, Atul Kamble,"Electricity Generation from Speed Breakers" in the International Journal of Engineering and Science(IJES)||Volume 02, Issue 11, ISSN:2319-113, 2013.

[6] R.Manasa Veena, B.Harika Reddy, S.M.Shyni "Maximum energy harvesting from electromagnetic microgenerator by footstep using photosensor" in ICCPEI:IEEE, 978-1-5090-0901, May 2016.

[7] Md.Raseduzzaman Ruman, Mukta Das, S.M.Istiaque Mahmud "Human footstep for energy generation by using Piezoelectric tiles" in i-PACT, 978-1-5386-8190, IEEE, Sep 2019.

[8] Nathan S.Shenck, Joseph A.Paradiso,"Energy Scavenging with shoe-mounted piezoelectrics" by IEE computer society/ACM joint task force on computing curriculum, 0272-1372, May-June 2001.

[9] Alla chandrasekhar, B Murali Kishore, T Jogi Raju,"Electromagnetic footstep power generation in ISSN" 2250-3153, Volume 4, Issue 6, June 2014.

[10] B.Munaswamy, C.prudhuvi, V.Srikanth, B.Kiran Kumar, E.pradeep Kumar"Mechanical Footstep power generation in IIETA", Volume 5, Issue 2, March – April 2018.

[11]Tom Krupenkin, J.Ashley Taylor.Reverse" Electrowetting as a new approach to high power energy harvesting in Natural communication",2:448, 23 August 2011.